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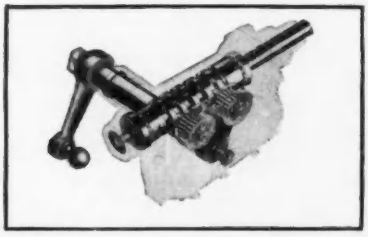
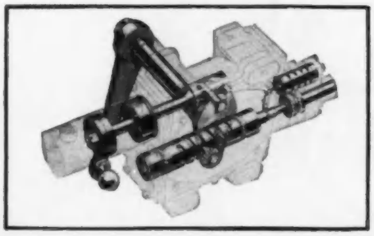
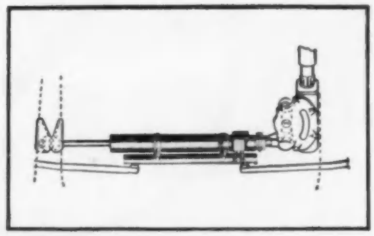

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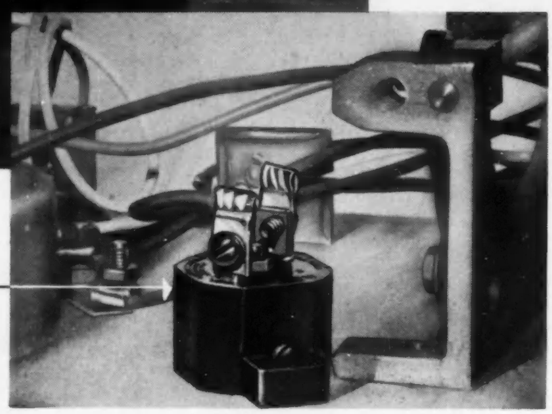
KLIXON CA20 amp. automatic reset breaker installed on the Sea Breeze



"KLIXON CIRCUIT BREAKERS

add measurably to the safety of operation of our 20 Ft. Sea Breeze Cruiser"

MR. JAMES R. McQUEEN, Jr., President

Illustrated is the popular Sea Breeze Cruiser manufactured by the Trojan Boat Co., Lancaster, Pa. A Klixon Circuit Breaker is used to protect the electrical circuits because their experience proves that these breakers add to the safety of the boat. Mr. James R. McQueen, Jr., President, writes:

"I am very pleased to personally add my endorsement to that of our Engineering Department when they selected your #CA20 Klixon Circuit Breaker as a means of protecting the electrical system of our new and very popular 20′ Sea Breeze Cruiser.

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No matter what type of mobile you manufacture . . . boats, trucks, buses, cars, tractors, aircraft . . . it will pay you to use Klixon Circuit Breakers for sure, dependable, permanent circuit protection.

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For the Sake of Argument

Fears and Failures . . .

By Norman G. Shidle

Fear may motivate more of our actions and reactions than most of us like to think.

Digging deep enough into ourselves, we may find we hurry because we worry; that we seek perfection to avoid censure; that we bypass trying for fear we'll fail.

Fear that we're wrong may spark our strongest protests that we are right; fear that we are cowardly, drive us to major deeds of bravery.

. . . But isn't confidence, rather than bravery, the real opposite of fear? What seem to the fearful to be acts of bravery may be the normal manifestation of an inner confidence. Confidence may come to the man who has no fear of failure, as easily as to him who feels sure of success. Fear overcome never brings as good results as fear dissipated.

Very often fear of failure may harass us more than failure itself. Our individual attitude often decides whether or not our fears are realized. For instance:

We all know at least one fellow who never seems to get the breaks. Nothing ever seems to go quite right for him. There is never much meat in his hash. Almost every day, something goes wrong. He's just a hard-luck guy.

Then we all know another kind of fellow. He rarely seems to have troubles. His house burns down, his automobile won't run, and his golf score gets higher each year . . . but he never has any bad luck. . . . He feels good because his house was covered by fire insurance; he's lucky because his car broke down near home. Taking more golf strokes gives him more exercise.

Charles F. Kettering has never feared to fail. He has consistently looked on failure as one of life's best opportunities. "It doesn't matter how often you fail," he has said in effect, "as long as you don't fail on the last try." More than a few times, engineers have turned unproved guesses into established facts by seeing in failure an unfoldment of good, rather than something to be feared.

"Fear," says Aldous Huxley, "cannot be gotten rid of by personal effort, but only by ego's absorption in a cause greater than its own interests."

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Contents—November, 1954

Society of Automotive Engineers, Inc.

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Today's most wanted power features for cars and trucks

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With over four million in use, the Bendix Hydrovac is by all odds the world's most widely used power brake for commercial vehicles. This overwhelming preference for Hydrovac is a result of sound engineering design, exceptional performance, low original cost and minimum service upkeep.

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With one simple compact unit, Bendix Air-Pak combines all of the well-proven advantages of hydraulic brake actuation with an air brake system. An important advantage of Air-Pak is that brakes can be applied by foot power alone when braking is required before air pressure builds up or if it should fail for any reason.

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The term "Bendix Power" not only identifies the industry's outstanding power braking and power steering equipment, but describes the unmatched engineering and manufacturing resources behind these products.

It is well that Bendix Products Division be thought of in this dual capacity, for the outstanding acceptance of Bendix power units stems largely from the fact that industry has learned over the years to look to Bendix for the latest and best in power equipment for cars, trucks and buses.

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Personnel Faces Challenge As Automation GROWS

R. L. Woodruff Thompson Products, Inc.

Based on secretary's report of Factory Personnel Relations Panel held as part of the SAE Aeronautic Production Forum, April 12, 1954.

AUTOMATION can't eliminate the problem of getting results from people!

AUTOMATION has taken a machine with push-button controls and an operator 40 ft away and equalled the output of 400 men operating standard machines.

In another operation it has reduced manpower from 337 to 42, cut floor space from 44,000 to 10,000 sq ft, and reduced machinery allowance from $2,200,000 to $600,000.

But people still run the automation.

In an industrial economy where change has become the only constant, much more is required of management if it is to create a versatile working force ready and willing to accept the challenge of automation. American industry never has tapped the full potential of human beings. This is the big job for management: to provide workers with the skill as well as the will to adapt to the changing industrial technology.

Skill will increase with more intelligent approach to selection, training, and placement: anticipating future needs and changes; training people properly in basics; having vocational information available when personnel actions are taken.

The will to work is a function of employee attitudes toward the company, the job, and supervision. Foremen polled in one company liked supervisors who explained jobs clearly, had confidence in their ability and allowed independent judgment, and showed an interest in their ideas and problems.

Good Communications Vital

Workers on all levels want to "belong" and to be recognized as individuals. Communications, used for a two-way interchange of thoughts rather than one-way dissemination of information, can satisfy these needs.

Employees were polled in two nearly identical plants of the same company. In the first, where

Discussing Automation's Challenge

Panel members who described new personnel needs in the age of automation were:

R. S. Livingstone, Panel Leader
Thompson Products, Inc.

R. L. Woodruff, Panel Secretary
Thompson Products, Inc.

Howard Dirks
Chrysler Corp.

Joseph Kopas
Republic Steel Corp.

C. A. Myers
Massachusetts Institute of Technology

the manager held monthly meetings with employees to discuss new policies and plans, 62% of the employees felt informed; 62% had a feeling of belonging; and 45% considered the employer the best in the area. In the second plant, where no meetings were held, percentages were 18, 29, and 22. Employees in the second plant wanted more information on the company's future prospects and promotion policy.

Communications must be well planned and organized to be effective. Its main channel should be through the company's line organization, with foremen and supervisors the key people.

If top management believes in communications, develops an effective plan, and supports it wholeheartedly; if communications are continuous, prompt, frank and complete; and if they are made understandable in terms of employee interest, management will have established a valuable tool in achieving employee understanding and cooperation.

(The report on which this article is based is available in full in multilithographed form together with reports of six other panel sessions of the 1954 SAE Aeronautic Production Forum held at the SAE National Aeronautic Meeting, New York, April 12, 1954. This publication, SP-307, is available from the SAE Special Publications Department. Price: $1.50 to members, $3.00 to non-members.)

True Center Point Steering . . .

. . . would take the fight out of truck driving and reduce tire and axle wear. Larger payload and higher speeds make imperative a change in front axle design.

Based on paper by **A. S. Page,** Page and Page Co.

THE split axle system used on trucks is still a compromise of bad angles, despite the notable efforts of axle manufacturers. It isn't adequate today in view of growing demand for larger payloads, which impose more weight on the front axle, and the ever increasing speeds.

Conventional front axle design is based on the theory of near center point steering. To accomplish this type of steering results in features which add up to hard steering, driver fatigue, excessive tire wear, and extreme wear on the axle itself. The time has come to try a new concept in front axle design—true center point steering.

True center point steering eliminates the need for camber (king pin inclination) because the pivot point (king pin centerline) and wheel centerline are imposed one on the other. This creates a true geometric pattern and it is no longer necessary to overcome roll out or the leverage about the king pin centerline with toe-in (gather). A true rolling motion of the tires is attained. We also attain completely irreversible steering.

Since all road shock or sudden drag on the tires is transmitted directly through the pivot points to the axle beam, it has no effect on the operator and control is safe and complete at all times. This creates easier steering and less driver fatique. And it reduces tire wear and axle wear, particularly in the linkage parts, because the load on them is reduced.

True center point steering has been objected to on the grounds that moving the pivot point or king pin outboard to the centerline necessitated a deeper dish wheel. This was true with the conventional non-rotating spindle. However, the new axle design makes use of a rotating spindle and a non-rotative pivot hub mounted in the yoke and pivoted on steel balls resting in nylon cups, (See Fig. 1). The correct ball tension is attained by use of the adjusting screws. This eliminates king pin replacement. Adjustment for wear in the pivoting points is facilitated by taking up on the adjusting screws.

The ability of both wheels to travel independently in a true rolling path reduces the function of the tie rod linkage to that of a synchronizing mechanism between the two wheels to insure proper deflection while negotiating turns. This in turn reduces wear in tie rod linkage and eliminates the loss of control normally attended by breakage in any part of it. (Paper "True Center Point Steering" was presented at SAE National West Coast Meeting, Los Angeles, Aug. 16, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

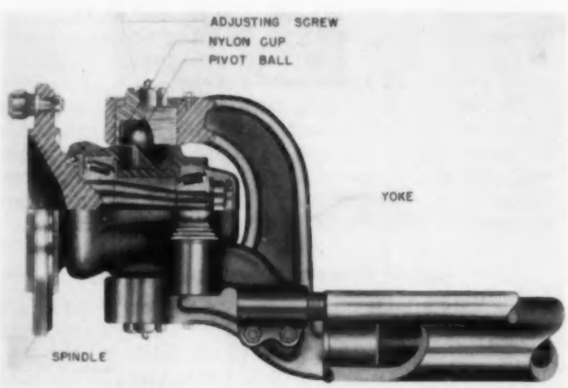


Fig. 1—New axle designed for true center point steering. Note the use of a rotating spindle and non-rotative pivot hub mounted in yoke and pivoted on steel balls resting in nylon cups.

Some Thoughts on Automatic Transmissions for Heavy Trucks

M. C. Horine, Consulting Engineer, Mack Mfg. Corp.

Based on paper, "Automatic Transmissions for Heavy Trucks? If—How—and When," presented at a meeting of the Metropolitan Section of the SAE, New York City, Feb. 17, 1954.

PRESENT transmission types, as applied to large-capacity highway commercial vehicles, are the result of many years of painstaking development and have been refined to a degree hardly equalled by any other class of geared mechanism. While by no means perfect, they do permit highly efficient operation, withstand an unbelievable amount of strenuous service and abuse, and can be maintained with little difficulty or expense.

Yet, under the stern lash of keen competition, straightjacket legislative restrictions, high taxes, and the demands of labor, and because the operating standards of truck operators are continually being raised, there are those who believe that present transmission types have about run their course and that new and radical types must be developed to meet the demands of the not-too-distant future.

If one were to start with a clean sheet of paper and no deterrent of unamortized tools, the first step should be a careful survey of the requirements to be met and an appraisal of what science and invention have to offer. These appear to be the objectives:

1. *Range of Torque Multiplication*—In conventional transmissions, range of torque multiplication and range of gear ratios are synonymous; but this is not necessarily true of transmissions operating on other than the principle of meshing gears. The range required will depend upon four things: the gross weights to be moved; the net engine horsepower available; the rpm at which maximum torque and peak horsepower, respectively, are delivered; and the nature of the terrain to be negotiated. The greater the gross pounds per horsepower, the broader the range of ratios must be; while the greater the spread in rpm between torque and horsepower peaks, the narrower it may be.

The fastest ratio, in connection with the proper final drive ratio, must be such as will provide not less than the maximum mph which the power-to-weight ratio makes possible. This is not just the mathematically apparent speed; but that which can actually be attained on level concrete. At the same time it must not be such as to subject the driveshaft to rotative speeds beyond safe limits for universal joints, for driveshaft balance, and rear-axle driving pinion size.

To provide gradeability for the steepest grades anticipated, the slowest ratio must be adequate. This is usually slower than ordinarily required for starting. Michell[1] recently discussed the results of

[1] See SAE Transactions, Vol. 62, 1954, pp. 396–410: "Drive Line for High-Speed Truck Engines," by W. P. Michell.

careful research as to the ratio requirements of future transmissions, taking into account the present trend toward greater horsepower, the unlikelihood of material increase in gross weights and the tendency toward increased engine speeds. Largely because of the preference for single-reduction rear-axle drives and their limitations as to ratio and the limitations of driveshafts and universal joints, Michell definitely ruled out the overgeared transmission.

2. Ratio Intervals—The next most important consideration is the intervals between ratios within such range. Naturally, the intervals will have to depend upon the number of speeds provided; or perhaps the other way round, the intervals required will dictate the number of steps. If the ideal infinitely variable transmission were to become a reality, of course, this problem would disappear, as there would be no intervals—no steps. But, unless we make the mistake of considering the torque converter as an infinitely variable transmission, our present state of knowledge impels us to accept the necessity for some form of stepped progression through the range.

Four considerations should govern:

1. Ease and celerity of shifting.
2. Fuel economy.
3. Proper intervals of ratio.
4. Rapid acceleration over the full range.

This certainly makes the idea of the so-called "hot shift," in which the torque is not interrupted during shifting, most attractive.

In his analysis, Michell presents some potent arguments leading to the conclusion that the presently accepted ideal of geometric progression of ratio intervals is not entirely sound. We have hitherto proceeded on the assumption that if each successive ratio is, say, 1.25 times the next lower numerically, we would provide a succession giving the most advantageous pattern for both shifting and operating effectiveness. Such a progression provides a uniform range of engine speeds in each shift, a desirable gathering of the ratios at the top, and a progressive widening at the bottom.

By a study of the duration of operation in each speed of a representative sample of over-the-road operators, however, Michell concludes that a more radical pattern would be preferable, the top ratios being more closely spaced and those at the bottom still further apart. Unquestionably, due to the generally improved nature of the main route highways, there is much to support this view as it applies to over-the-road intercity operations.

Table 1 shows the resultant road speeds (assuming 50 mph top speed) for the progression suggested by Michell. In addition, for comparison, a similar tabulation covering a modern 10-speed duplex transmission is added. The big drop in road speed for a small increase in gear reduction at the top, contrasted with the small speed loss with large steps at the bottom, makes it clear why graduated multiples of reduction are desirable.

For city service, heavy hauling, dumper, and mixer work, however, there seem to be good grounds for contending that the steps near the bottom need to be even closer together than at present, with less need for gathering at the top.

Table 1—Michell Progression of Ratios Compared with Geometric Progression and Progression Used on Modern Duplex Transmission

Michell		Geometric		Modern Duplex	
Ratios	Mph	Ratios	Mph	Ratios	Mph
1.00	50	1.00	50	1.00	50
1.10	45.5	1.40	35.7	1.28	43
1.25	40	1.96	24.6	1.63	30.3
1.50	33.3	2.75	18.2	2.09	23.8
2.00	25	3.85	12.9	2.60	19.2
3.00	16.67	5.39	9.3	3.34	14.9
7.55	6.62	7.55	6.62	4.35	11.5
				5.59	8.4
				8.05	6.2
				10.34	4.8

3. Continuous Torque—Uninterrupted acceleration is one of the characteristics of the new passenger-car transmissions which arouse the enthusiasm of drivers, largely because of the aesthetic effect. It has appeal in truck transmissions for very different reasons. It is possible to provide continuous, though not uniform, rate of increase or decrease in a step-type transmission, as is illustrated by the Hydramatic. There appear to be two ways in which this so-called "hot shifting" can be accomplished in a stepped-ratio transmission.

One way is to have overlapping engagement of successive speeds, so that one speed is gradually picked up as the other is gradually released. This is easily conceivable in a planetary type, where friction bands and/or clutches are used. The other is through the use of overrunning clutches. The latter would be objectionable if they allowed free-wheeling of the vehicle, the prevention of which might involve considerable complication.

4. Shifting Control—There is no question that a properly designed automatic shifting device, responsive to both speed and load, would provide the closest approach to perfection in the control of a stepped transmission. It would provide as nearly as possible the correct shift at the correct instant under all operating conditions and would relieve the driver of one of his most onerous and exacting tasks. However, strangely enough, drivers themselves seem to be the chief opponents of automatic control. Perhaps this reaction is compounded of mistrust of gadgets and professional pride. Most of us take pride chiefly in our ability to do difficult things, not easy ones.

Short of automatic control, the next most desirable thing is easy, positive, and accurate manual con-

trol. Power actuation can take the physical effort out of shifting, and numerous means are available now to make such operation positive and quick. Accuracy, that is, the correct selection and timing of shifts, usually depends upon the judgment of the driver; but can readily be improved by devices which indicate when upshifts or downshifts should be made. It is possible that, with control sufficiently simplified and eased, power actuation may not be needed.

5. *Mechanical Characteristics*—For commercial practicability, a transmission achieving the above objectives must be sufficiently simple and sturdy to satisfy the following:

1. It must be compact enough to be applicable to short-wheelbased tractor and COE chassis.

2. Its weight should not be much, if any, greater than present multispeed arrangements.

3. It ought to have sufficient stamina, durability, and reliability to provide a useful life and overhaul intervals not less than that of the engine—perhaps 500,000 and 100,000 miles, respectively.

4. Its mechanical efficiency must be high enough so that overall results in performance and economy will compare favorably with those of present-day types.

5. It should be readily accessible for adjustments and overhaul.

6. It should be simple to maintain, lubricate, and adjust.

7. It should be quiet in operation.

8. It should be reasonably low in cost of production in anticipated quantity.

Transmission Possibilities

So much for the objectives. These are the characteristics which we should seek in selecting the form and principle of the new transmission and in its development and adaptation to trucks. Of all the sometimes ingenious, often impractical, and occasionally promising transmission ideas put forward since the dawn of the industry, a surprisingly small number have been accorded any serious attempts at development. A very few, which seem to give promise of adaptability to our problem, are:

1. Planetary: In the mechanical classification, the planetary gear offers some of the most alluring possibilities. For a given ratio range and torque capacity, its gears are most compact. Reaction forces are inherently so balanced that stresses and strains on its bearings and case are reduced in magnitude and favorable in direction. Its various ratios may be brought into play somewhat independently, whereby such overlap may be incorporated as to permit virtually continuous torque through a series of ratio steps. It can be made to operate quietly and to produce high mechanical efficiency.

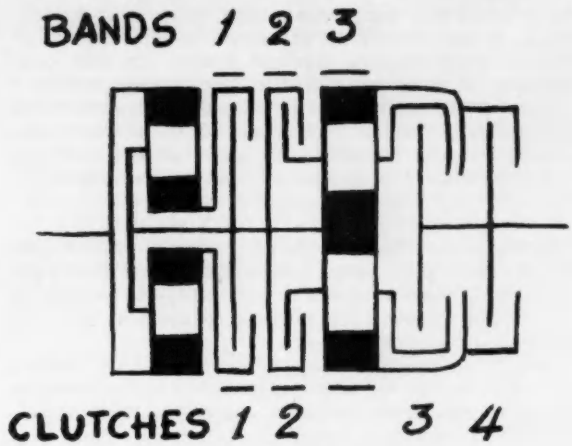


Fig. 1—Four-speed planetary

Among its drawbacks may be mentioned the following:

(1) Recourse must be had to clutches, and, as the number of speeds increases, the complication of such clutching arrangements soon approaches the point where the means of control take up about as much room as the gears themselves and may involve a bewildering complexity of mechanical, hydraulic, pneumatic, or electrical devices and connections. (See Figs. 1 and 2.)

(2) The actual ratios which are practicable in a planetary set are seriously restricted.

(3) Bearing support for the various members also presents difficulties unless one is willing to go

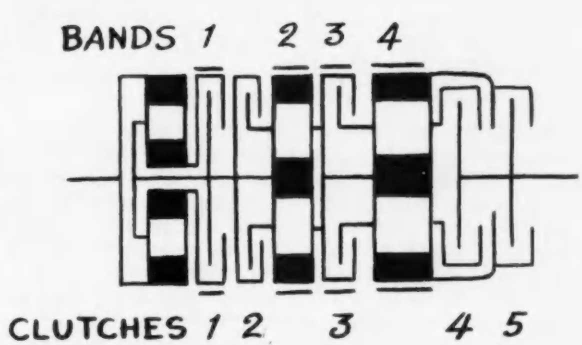


Fig. 2—Seven-speed planetary

to plain sleeve or needle bearings in some locations.

A variation of the planetary principle that has seen numerous adaptations and that, it is understood, is still receiving attention is that in which friction rolls replace toothed gears. In this case adhesion is obtained either by prestressed assembly of cylindrical elements or by the use of tapered cones and rollers. In the past some of these have employed friction materials on some of the surfaces and others have been metal to metal throughout.

2. Other mechanical forms: Mixed systems, in which both planetary and countershaft arrangements are combined are a possibility, by means of which the limitations of both principles may be mitigated to some extent.

Centrifugal clutches have been used to a limited extent in motor vehicle transmission arrangements. They would seem to offer some possibilities, although experience certainly indicates that they have distinct limitations.

Countershaft stepped-gear transmissions have been projected in which the gears are constantly in mesh and different sets are brought into play by means of individual friction clutches, in much the same way as in conventional types, and they are engaged by positive gear-type clutches. In the conventional single-countershaft arrangement, the length added to say a 5-speed transmission by the incorporation of six such clutches would be far beyond the range of the practicable, even though half of them could be carried by the countershaft and half by the splineshaft. Clustered multiple countershafts would permit shortening such a box; but would involve a large increase in diameter.

Clutches for such a transmission could be of the multiple-disc-in-oil type, magnetic, or even of the cone type. They could be reasonably harsh in action if supplemented by a conventional master clutch at the flywheel. They would undoubtedly have to be power actuated.

3. Electrical: Electrical transmissions offer true infinitely variable characteristics through a much broader range of torque and speed than torque converters, together with the same type of inherent automatic control. They are mechanically simple and can be built with extreme ruggedness.

Notwithstanding early adoption, particularly for busses, the electric drive has disappeared from the automotive field, largely because of relatively high cost, weight, and efficiency.

4. Pneumatic: Pneumatic drives have been investigated with the possibility of returning to the pump-and-motor principle of the hydrostatic drives, substituting elastic air for noncompressible oil as the operating medium. One of the knottiest problems in connection with pneumatic systems is the wide heat differential between compressor and motor, with the large energy losses resulting. It is at least conceivable that a closed heat system might be incorporated so that the heat rejected by the compressor could be recovered by the expanding air in the motor. The problem of water vapor, dust, accumulation of lubricant, and consequent gumming of valves, and so on, might be solved by the use of a closed air system.

However, for the sake of size and weight, the air would have to be handled at high pressure. It is doubtful if the quality and precision which this would require in manufacture could be produced at a price comparable even with that of the electrical transmission.

5. Hydraulic: Pioneered on buses, which are certainly heavy vehicles, the torque converter and its cousin, the fluid coupling, have proved themselves to offer certain inherent advantages no less desirable in heavy vehicles than in light ones. Extended to the extremely heavy off-highway types, the torque converter has also met with a modicum of success.

There are three classes of hydraulic drives:

(1) Hydrostatic drives. As applied to motor vehicles the hydrostatic drive has not worked out successfully owing to large heat losses occasioned by fluid friction, vibration, and hammer, the latter being due to the difficulty of maintaining uniform flow through pumps and motors, the intricate passages involved, and the relative incompressibility of a liquid.

(2) Hydrokinetic drives, such as the fluid coupling. The fluid coupling is incapable of multiplying torque, so that it acts purely as a coupling. At idle speed it transmits practically no torque and reaches its maximum efficiency only when the slip or difference in speed between the impeller and runner reaches a minimum value.

(3) Hydrodynamic drives are similar in general form to the fluid coupling. The torque converter, as this device is called, however, differs considerably in its action, in that it has the ability to enhance the torque originally received by the impeller.

Torque versus Speed

Right here is one of the most important differences between the action of the torque converter and that of gearing. In gearing, output torque and speed are always reciprocal in their relation to those of input. You get in torque gain exactly what you pay for in speed loss. Not so in the torque converter. For a given gain in torque, the loss in speed is greater than proportionate. For twice the torque you must sacrifice considerably more than half the speed. This disparity in reciprocal relation varies greatly at different loads and speeds in a given converter and as between different converters under the same circumstances.

Adaptation to Engine

Operating characteristics of both fluid couplings and torque converters are affected by the relationship of their diameters and blading to the torque and speed characteristics of the engine with which they are associated. For example, the speed at which they reach the clutch point, the speed at which maximum stall torque is produced, or the rate at which the engine will accelerate under full load can all be controlled to a considerable extent by the

design of the converter. How it affects vehicle performance is easily seen.

Adaptation to Transmission

In adapting either a torque converter or a fluid coupling to a countershaft type of transmission, it is necessary to provide a friction clutch, preferably between the hydraulic unit and the transmission, in order to permit gearshifting. If the converter is not of the transitionary type, furthermore, another friction clutch is required between the engine and the impeller and either a third friction clutch or a synchronized positive clutch between the converter output shaft and the engine, for direct drive.

Planetary transmissions, on the other hand, do not require disconnection from the converter for shifting, which helps to compensate for the fact that multispeed arrangements involve a plurality of friction clutches in such a transmission.

Hydraulic Advantages

Among the allurements of both forms of hydraulic drives are these:

1. Operation is simplified. The vehicle may be idled in gear and set in motion by merely pressing on the accelerator.

2. Engine stalling is eliminated. This is particularly valuable as an aid to traction in slippery going, as it permits the wheels to be turned at extremely slow speeds—speeds which are impracticable in many cases with straight mechanical drive. It is well known that the adhesion of the tires to the road surface is greatest when the speed is slowest.

3. Friction clutches, if used at all, are subjected to greatly reduced duty, since they are not required to pick up the driving load, but merely the inertia load when shifting. Thus, one source of wear, causing expense and occasion for frequent adjustment, is eliminated.

4. Drive-line shock and vibration are greatly reduced, including that originating at the drive wheels, that occasioned by shifting, and that imposed by the engine. This cushioning effect is of tremendous benefit to every part affected and, in addition, it makes operation more pleasant. Avoidance of drive-line shock, furthermore, offers additional facilitation of traction, since shock torque reduces adhesion in slippery going.

Two additional attractions of the torque converter exclusively are:

1. Retarding effect in drifting or coasting can be offered by the torque converter in addition to that of the engine by means of a brake on the stator of the transitionary-type converter or a clutching arrangement whereby the impeller is uncoupled from the engine and connected with the output shaft. The fluid coupling is reversible, so that in drifting it is able to transmit torque to the engine from the output shaft, thus offering nearly as much retardation as a direct mechanical connection.

2. Because of its ability to multiply torque, the converter decreases the reduction necessary for starting and acceleration and for surmounting obstacles and therefore may reduce the number of transmission speeds required. Its smooth, shockless starting and acceleration may increase the overall acceleration rate. The fluid coupling, on the other hand requires the same number of ratio steps as positive drive through the conventional friction clutch and somewhat decreases acceleration.

Not a Transmission

So effective is the torque converter in these respects that, in the case of mass transportation buses, it has had widespread and successful application in which only one forward transmission gear is provided, the converter taking the whole duty of providing the torque increase necessary for starting and for grades. This has misled some to expect that similar results might be secured in passenger cars and trucks. That such application is impracticable is due to the fact that the efficiency of the torque converter is much too low for continuous operation in its range of torque multiplication and to the further fact that its range of torque multiplication is inadequate to replace the transmission entirely.

This is why intercity buses retain conventional drives. Passenger cars, even though they have extremely high power-to-weight ratios and operate most of the time in direct drive, supplement their torque converters with transmissions having two or more forward speeds. Off-highway trucks using torque converters also find such additional ratios essential.

Success of the simple arrangement in buses is accounted for by the stop-and-go nature of their operation, in which stops of from 7 to 20 or more per mile require almost continual acceleration and deceleration. In this type of operation, the torque converter is at its best. The frequency with which gearshifts would be necessary with the conventional clutch-and-gearbox drive has been found to offset the higher theoretical efficiency of the latter, to involve so much maintenance, and to increase the work of driving so that it has made the conventional type intolerable in mass transit buses.

The fact is that the torque converter, no more than the fluid coupling is not to be considered a form of transmission; but rather as a form of clutch. Save in such special cases as already noticed in connection with mass transportation buses, certain off-highway vehicles, and certain industrial applications, it is not adapted to continuous operation in lieu of gear steps. In its proper place it enjoys important advantages over either friction clutches or fluid couplings.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

E. A. Martin and J. H. Goffe,

Mechanical Laboratory Section
Products Division, Socony-Vacuum Laboratories

Based on paper "A New Engine Analyzer" presented at SAE Summer Meeting, Atlantic City, June 10, 1954.

Special

TO STUDY normal and abnormal engine operation, Socony-Vacuum Laboratories are using a special cathode ray engine analyzer.

The analyzer has so far served chiefly for ignition analysis and for flame and preignition studies. It has been used also for studying the coil primary current, engine noise, combustion knock, ignition timing, and operation of intake and exhaust valves. The list of applications will grow longer with time.

Transducers can convert almost any engine performance factor to a voltage or current signal for study on the oscilloscope.

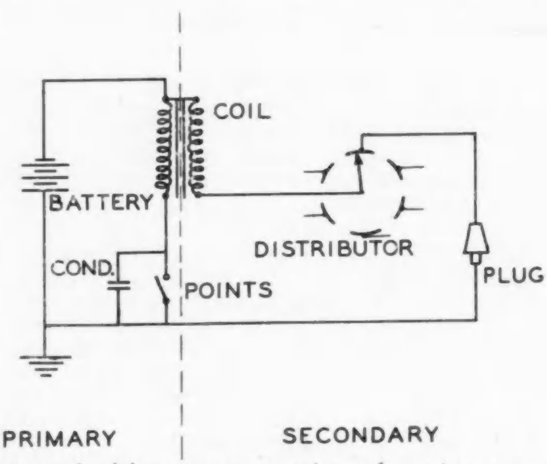
The Socony Vacuum engine analyzer differs from other analyzers in that it generates one line for each cylinder of the engine. This allows use of the full width of the picture tube for each line.

The analyzer is synchronized to the engine by (1) a signal from the No. 1 spark plug high-tension lead and (2) a signal from the coil-to-distributor lead. The signal from the No. 1 spark plug lead serves to initiate the movement of the plotting beam of light in the vertical field. This signal occurs once every second revolution of the engine. Each set of lines represents one engine cycle. The signal from the coil-to-distributor lead serves to initiate the horizontal movement of each individual cylinder line. After the top line, it displaces each subsequent line downward slightly from the last one, until the last cylinder has registered.

The advantage of this multi-line raster arrangement is that it doesn't bunch up the characteristics of all the cylinders on one horizontal line. Nor does it overlay the plot for one cylinder over its predecessor so that a misbehaving cylinder is difficult to identify.

The upper left-hand corner of the pattern denotes the time of firing of the No. 1 spark plug. The oscilloscope beam then traverses the multi-line raster until the next firing of the No. 1 spark plug. Thus one full raster represents 360 deg of distributor rotation—or 720 deg of crank rotation.

The total length of all lines may then be scaled so that, knowing spark timing, the experimenter can find the crank angle of any particular event. For example, dwell angle for each individual cylinder may be checked to ½ deg accuracy—which is the limit imposed by distributor accuracy. The experimenter may determine differences in firing time the same way.



Battery ignition system consists of a primary and a secondary circuit. Analysis of either of these circuits is simple and convenient with the analyzer multi-sweep raster display. Wide experience with the analyzer in ignition analysis shows that secondary voltage displays are far more revealing. Fact that the two patterns differ proves the coil doesn't act as transformer during sparking.

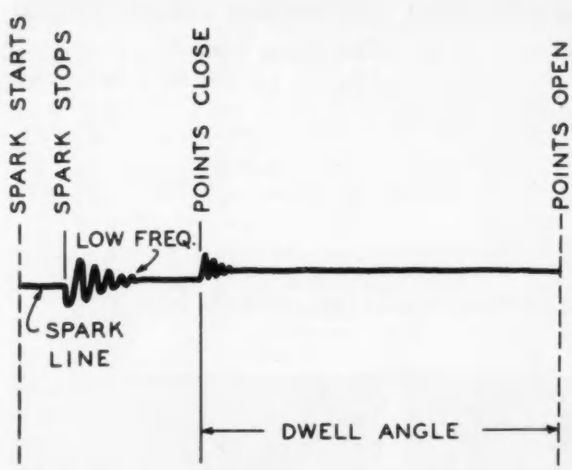
Oscilloscope Profiles Ignition

Looseness in timing chain, gearing, slotted drives, and breaker point plates shows up as irregularity of the end points of the lines. Intermittent malfunctions show up in the individual patterns.

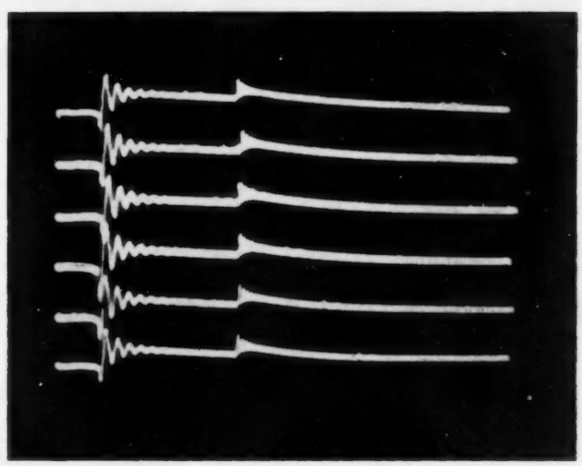
For preignition studies, the analyzer is used with a pressure pick-up or—where there is only one access hole—with a thermionic-gap spark plug which detects the presence of flame as well as provides the spark. Presence of flame in the combustion chamber prior to spark indicates preignition.

For both ignition and preignition studies, secondary coil voltage is usually used for the display.

The illustrations below and on the following page show the plots the Socony Vacuum engine analyzer yields.

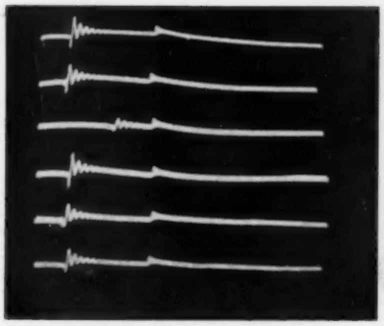


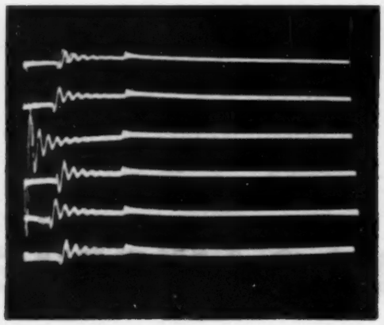
Typical secondary voltage pattern for one electrical cycle for one cylinder shows the events of the cycle. Malfunction of a common component appears as deviations on all lines. Malfunction of a spark plug appears on the spark-line portion of the voltage pattern of the affected plug. Breaker point problems appear at "points close" or "points open" signals, or in between.

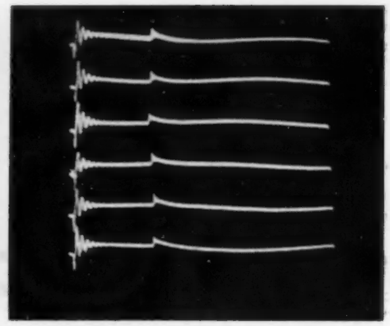


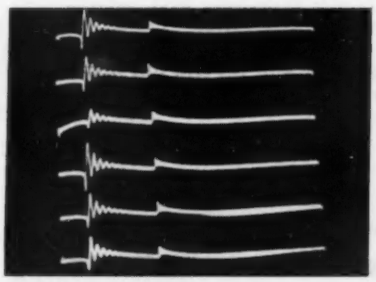
Engine analyzer raster display of a six-cylinder engine ignition system in satisfactory operating condition looks like this. Topmost line shows the ignition events associated with the No. 1 cylinder. Subsequent lines show the patterns for the other engine cylinders in firing order. **Typical patterns for faulty ignition and for preignition appear on the next page.**

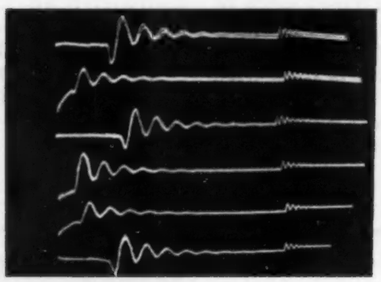
Ignition Studies Using Secondary Coil Circuit Voltage

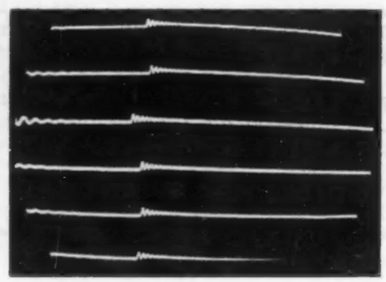

Shorted Spark Plug


Open Spark Plug

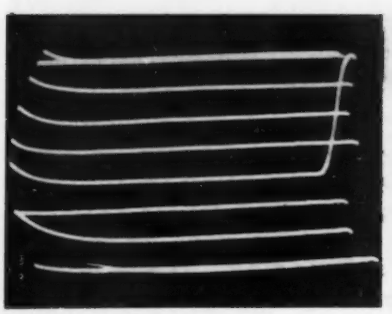

Low System Energy

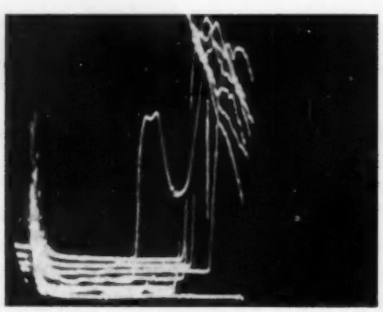

Mild Deposit Foul

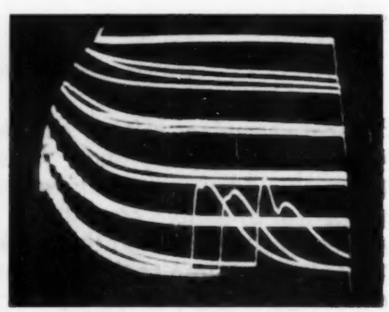

Severe Deposit Foul

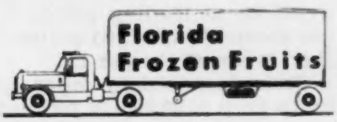

Cam Slope Variations
(Center portion of curves only)

Preignition Studies Made with Thermionic-Gap Spark Plug


Mild 2-deg Preignition


Severe Preignition


False Signal—Loose Connections



What Type Refrigeration?

How Much Insulation?

Panel and audience tried to answer these and other questions, and came up with a confused picture—one that reflected well the situation faced by fleet operators

Henry Jennings, Fleet Owner

Based on secretary's report of Round Table on Operation and Maintenance of Refrigerated Vehicles held under the auspices of the SAE Transportation and Maintenance Activity at the SAE Summer Meeting, Atlantic City, June 8, 1954.

CHOOSING the right type of refrigeration is almost as complicated as selecting the right type of truck. The types available are many. Each is aimed at providing some variety of one of the three main types of service:

- Processing in transit, where cargo is received warm and must be delivered cold;
- Low temperature (frozen foods and ice cream), merchandised from the vehicle or ordered for follow-up delivery;
- High temperature (meats and sausages), sold from the truck or ordered for follow-up delivery.

Whichever the operator needs, he must have thermostatically-controlled temperature, reliability, reasonable original and operationg cost, and ease of unit replacement. His particular weight and space requirements must be met, too.

To satisfy his special demands, the operator must choose among straight mechanical units, dry ice units, chilled plates, and any combination of these with standby charging. Wet ice and wet ice with blowers, forerunner of these systems, seems to be on the way out because of weight and bulk.

One operator expressed a preference for the compressor mounted under the hood for mechanical types. This means only one engine to maintain, and better maintenance accessibility . . . but leaves the problem of whether to equip the truck with standby equipment for use when it stands still.

Another operator who reported using all types of refrigeration preferred the fan-shaft-driven compressor and mechanical refrigeration. In distribution centers where there is sufficient maintenance crew to care adequately for refrigeration equipment, many self-contained mechanical units are used;

Rating Refrigeration . . .

Panel members who expressed the opinions included in this article were:

A. W. Neumann, Leader
The Willett Co.

Henry Jennings, Secretary
"Fleet Owner"

O. A. Brouer
Swift & Co.

E. W. Lager
Volz Brothers, Inc.

A. C. Schmidt
Armour & Co.

A. L. Springer
Spector Motor Service

otherwise, holdover plates of one kind or another are used.

Since plant refrigeration systems frequently are available at loading points, it is often possible to use ammonia-charged plates. Cost of refrigeration then is about 10¢ per hr.

Costs described by other operators were 52¢ per hr to keep a 24,000-lb payload cool for 63 hr, with an extra charge of dry ice on the third day; and 37¢ per hr in a test in which most of the dry ice cost went into the precooling operation.

Chief complications with the mechanical type are seepage and hose troubles and too many flexible lines to complicate the underhood layout. Recommended as partial solutions were more understandable maintenance material; standards for fittings; and a more realistic rating of electric motors.

Education—of management as well as drivers and mechanics—is essential for best results with refrigeration equipment. Drivers are apt to consider refrigeration as something apart from their jobs and to be careless about it, according to one operator. And mechanics, proficient with most machinery, are inclined to be wary of refrigeration systems . . . to feel that changing expansion valves and adding Freon will cure whatever trouble exists.

Management often expects miracles of refrigeration once it is installed. It seems convinced most refrigeration is a chilling device to reduce temperature of warm cargos, and does not believe sufficiently in the efficacy of canvas loading curtains and closed doors.

Discussion of insulation pointed up the old problem of how to make trucks flexible enough to fit several type jobs without paying the penalty when the specialized job comes up. How much of those precious commodities—volume and weight—can the operator afford to give up when payload is to be refrigerated only a fraction of the time—possibly one-third?

Problem can be lessened, it was suggested, by making insulation more effective; that is, keeping it dry. One operator present had evidence of a pickup of water weight as high as 1500 lb. Actual weight increase is only one drawback: the vehicle is also carrying around insulation that doesn't insulate.

First step to prevent moisture accumulation is to make sure the outer skin of the body is airtight. (This is not simple; ordinary body-building measures are not good enough.) Spraying the outer skin with a plastic, made especially for the purpose, will do this.

There is some argument about making inner skin airtight. Some operators believe air will get into the insulation and condense with no means of escape. One new solution—putting insulation in airtight plastic bags—has its drawbacks too. One such insulation had to be made with pinholes in the plastic bags to prevent ballooning.

Turbojet Engine Life . . .

. . . still too short. Foreign object damage is major reason for premature engine removals. Automatic "gadgetry" frequent cause of engine malfunction, Navy finds.

Based on paper by **J. Denny Clark,** Bureau of Aeronautics, Dept. of the Navy

HIGH air flow and the location of the airplane inlet ducts with reference to the ground makes the turbojet engine particularly vulnerable to foreign object damage. Thus far, none of the various inlet screen configurations which have been tried has entirely solved the problem.

The Navy has chosen to operate axial flow engines without screens because of the thrust loss of 3 to 5%, the susceptibility to icing, and the weight penalty of retractable screens. Without screens the number of damaged compressors in engines returned for overhaul averages about 18%, although in some instances the figure has run as high as 23%. Screens are used in centrifugal engines because the thrust loss and weight penalty are low. Even with screens, approximately 19% of the engines are returned for damaged compressors.

Based on limited overhaul reports for two of our more recent engines, compressor damage is the reason for 56% of premature engine removals. Thus, it is evident that it makes little difference whether screens are used or not. Cost of repairing an axial flow compressor usually runs much higher

Notes on Naval Turbojets

- Combustion liner service life now averages from 160 to 250 hr.

- New ignition systems currently supplied on engines are providing consistent starts above 35,000 ft.

- Although a light engine oil is sprayed into the engine intake at each shut-down, approximately 20 man-hours are required to clean the corroded compressor blades at each 30-hr check.

- Spare engine procurement has been brought down from a maximum of 175% to a 45–55% figure with the aid of a new formula, thus making substantial savings for the government.

- Some of the newer turbojet engines have been operated as long as 1036 hr without requiring overhaul. The average operating life of 337 hr is still too low when it is appreciated that these engines cost as much as $200,000 each.

than repairing a centrifugal compressor. Normally only the inducer vane assembly of the latter requires replacement.

Air Force overhaul reports for 1954 show that approximately 20% of the centrifugal engines are removed for foreign object damage, while 45 to 80% of the axial flow engines (depending upon model) are removed for the same reason. Air Force technical orders require intake screens to be used on all axial flow engines, but it is known that some area commanders are removing screens to get better performance. It is difficult, therefore, to determine whether the high rejection rate for axial flow engines includes those with or without screens.

Airplanes appearing to be less susceptible to picking up loose material have the worst record for damaged compressors, while those with the so-called "vacuum cleaner" inlet ducts show a better record. The only possible explanation appears to be that service personnel handling the latter type understand the condition and take better care. Data also tends to indicate that foreign object damage is worse in winter than in summer.

Fuel controls and pumps are a source of trouble in spite of receiving more attention than any other device on the engine. First we added a pump to the one already provided so that fuel would always be supplied to the burner in case one pump should fail. It was required, for a while, that one pump had to be operated unloaded to keep it in good condition for emergency use. Then a cockpit light was added to tell the pilot which pump was in operation. In like manner, emergency features upon emergency features and more cockpit lights were added to the fuel control on the theory that every part of the fuel control and pumping system must fail safe at all times. Of course, much poundage and complexity was added to the engine. Service records showed that emergency features became less reliable than the main control and that when one pump failed, the other one usually gave out at the same time or shortly thereafter.

Presumably we went overboard trying to provide a safe vehicle for the pilot to fly. Today, we are re-evaluating some of these emergency and automatic switch-over features and eliminating them when we feel it safe to do so. Our approach is cautious lest we swing too far in the opposite direction. The Bureau of Aeronautics is now consolidating and tabulating all fuel control trouble reports from the field and from these we expect to evaluate better the need for emergency features.

Basic fuel controls are still not performing their primary function properly. Flame-outs, overtemperatures, speed droop, and compressor stalls are experienced at extreme altitudes. Poor starting and acceleration are also blamed on control. Some of the trouble can be charged to the wide range of fuels being used; contaminated fuel is a frequent cause of sluggish control action. Manufacturing tolerances frequently result in fuel control malfunctioning. Likewise, the wide flow limits required by some control manufacturers are claimed by some Navy personnel to cause many fuel controls to fail to meet engine fuel requirements.

At the Naval Air Test Center a program has been launched to flight test all new turbojet models with several controls to determine the acceptability of control variation. It will be cheaper to determine the compatability of several controls on several engines and make corrections during initial delivery than to wait upon field data. (Paper "The Navy's Experience with Turbojet Engines" was presented at SAE Southern New England Section, Springfield, Mass., April 6, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers).

Open Chamber or Divided Chamber:

HOW do various combustion chamber designs stack up against different requirements? The experts disagree. They divide into two major camps—one favoring the open (undivided) chamber, the other partial to some form of divided combustion space. Each camp claims much the same advantages for its favorite system, with one exception: the open chamber is admitted capable of better fuel economy than any other type. The proponents of the open chamber believe today's competitive conditions make economy of such importance as to admit of no compromise on this point.

Proponents of the divided chamber are just as vocal in justifying their designs. They admit that the slower combustion, which their designs are intended to produce, entails some loss of efficiency. But they point to the resulting lower rates of pressure rise which give a quieter engine and allow lighter construction. When the rate of pressure rise is reasonably slow with standard automotive fuel, there remains a margin which allows the use of fuels of a lower cetane rating without incurring objectionable knock.

Pintle nozzles can be used in divided chambers instead of the multiple hole nozzles which open chambers require. Pintle nozzles are claimed to be less subject to fouling and clogging and they operate with lower injection pressure. Both factors tend to give more reliable service at less cost.

Champions of the open chamber claim that a lot of diesel engine noise is due to the nozzles and that hole nozzles allow design of a much quieter injection system. They also claim nozzle fouling is not so much a function of the nozzle type as it is of the gas and air motion over the nozzle tip after injection. In good open chamber design, any fuel adhering to the nozzle tip is blown off. That eliminates the possibility of fouling.

The division among designers over the question of open or divided chambers exists only in the four-stroke field. An analysis of all automotive diesels, past and present, reveals 58 four-stroke engines with open and 54 with divided chambers, while among two-stroke engines there are 30 open to two divided chamber types. The reason for this lies almost wholly in the two-stroke's sensitivity to anything which interferes with good scavenging. Such interference does exist when a portion of a chamber is separated from the main cylinder by a relatively narrow passage.

Experts wonder if scavenging may not be responsible for the good economy of the four-stroke open chamber engine. Might not the air swirl have the effect of improving scavenging to such an extent that more excess air is available for combustion, rather than aiding combustion through better mixing of fuel and air? Either contention can be supported by examples.

In one instance, a two-stroke was operated on a six-stroke cycle so that changes in the scavenging process would have no effect on the amount of

Eight Engineers . . .

. . . discussing the merits of various diesel combustion chamber designs provided most of the material from which this article is drawn. They are:

R. L. Stanley
Round Table Leader
Diesel Engine Manufacturers Association

W. E. Meyer
Round Table Secretary
The Pennsylvania State University

John Dickson
Detroit Diesel Division,
General Motors Corp.

A. H. Glasenapp
International Harvester Co.

Bruno Loeffler
Mack Mfg. Corp.

A. W. Pope, Jr.
Waukesha Motor Co.

W. A. Wallace
Caterpillar Tractor Co.

Marsden Ware
Packard Motor Car Co.

Which is Best for Diesels?

W. E. Meyer, Pennsylvania State University

Based on secretary's report of Round Table on Combustion Chambers of Automotive Diesel Engines, held as part of the SAE Summer Meeting, Atlantic City, June 9, 1954.

fresh air available for combustion. When port angles were changed to give swirl rates from zero up, no change in performance could be detected, indicating no benefit from swirl.

In another case, a blown four-stroke with very large valve overlap was given different rates of swirl to find that the number of holes could be reduced drastically as swirl rate increased. Here, scavenging was no doubt exceptionally good even without swirl so that the experiment showed definitely that mixing is a function of swirl. Fuel economy was poor with extremely high rates of swirl because of increased heat rejection to the cooling water.

Though unable to resolve this contradiction, the experts do agree that chamber design must be evaluated by the attainable overall performance of an engine. A possible clue may lie in the fact that the swirl is initiated by tangential air entry at the bottom of the cylinder of a two-stroke, whereas with the four-stroke the air entry is at the top. That little is known about it is illustrated by the experience of one designer. He found that calculations of air entrance velocities indicated the swirl rate should be about 24,000 rpm, while measurements showed only 7400 rpm.

The maximum output obtainable from various chamber designs is also controversial. It appears that with natural aspiration, a BMEP of 105 to 110 can be obtained with any system provided, the manufacturer's definition of "permissible smoke" is accepted and the location of the maximum torque point is not rigidly specified. Much depends on the application for which the engine is designed.

When discussing dynamometer versus field performance, experts cannot agree on the reference temperature to use and whether it is wise to use two different temperatures for diesel (90 F) and gasoline engines (60 F). They think this a point for SAE restudy. They do agree, however, that diesel engine ratings must be based on some convention regarding permissible smoke in order to be comparable.

Behavior on the overrun seems not to be a problem with any type of combustion chamber provided measures are taken to keep the engine warm. The situation does not occur in off-highway applications. The ability to idle for prolonged periods is a must for any engine and apparently all combustion types are equal to the situation. Part load operation worries no one. If the combustion chamber and injection system can handle full and very low load performance satisfactorily, the intermediate range rarely gives serious trouble.

Proponents of both open and divided chambers agree that higher engine speeds are possible and both think they have the best chamber design for it. We don't have diesels operating at gasoline engine speeds because economy deteriorates rapidly as present-day top speeds are exceeded due to the falling off of mechanical efficiency. This is due to high gas speeds, whether in connection with the required air swirl or through the passages connecting the sub-chamber with the main combustion chamber.

In the final analysis, the type of combustion system the designer selects will depend heavily on the answers to these seven major questions:

1. Is the engine operating on a two- or four-stroke cycle?
2. To how broad a range of engine sizes should the same combustion system be applicable?
3. Is optimum economy or specific output the most important objective?
4. Must good economy or high output be maintained over a wide speed range?
5. How important is the ability to operate on a wide variety of fuels?
6. Is cold starting with aids important?
7. Must the engine be designed for minimum weight per hp?

The combustion system which answers these questions in a manner satisfactory to a given engine program must also be considered on the basis of such common requirements as minimum smoke, noise and odor, maximum serviceability and life, and the like.

Slow Engine Warmup

Is Headache to

ONE of the major problems facing car heater designers today is the slow warmup characteristic of modern engines.

Unfortunately for the heating engineer, a more efficient engine means that less heat is rejected to the coolant and consequently less heat is available for the hot-water heater. The lower rate of heat rejection coupled with a larger quantity of coolant in the engine block together with a greater metal mass points to a slow warmup.

The coolant in older 6-cyl engines reached the thermostat control temperature in 6–8 min, while a modern, overhead-valve, V-8 engine will require 10–12 min to reach the same control temperature.

Since the industry trend toward better and more efficient engines will contribute more and more to slow warmups, it would seem that some type of auxiliary heat source will be required to give acceptably short warmup periods. One of these is the gasoline booster heater, which was held to have possibilities, although the gain in warmup time might be disappointing. In addition, similar devices in the past have required considerable maintenance.

One expert estimated that a booster device would have to produce heat for the car occupants within 2 min and cost no more than $25 retail, to be successful.

Operation of the round table on car heating and ventilating was in the capable hands of the following:

Leader: T. C. Gleason,
Chrysler Corp.

Secretary: J. T. Moren,
Chrysler Corp.

Panel Members:

William Christensen,
Nash-Kelvinator Corp.

H. V. Joyce,
Ford Motor Co.

H. C. Simons,
Eaton Mfg. Co.

L. A. Zwicker,
Harrison Radiator Division, GMC

Air Distribution

There apparently isn't a single type of heating distribution system that stands out as *the* solution. The proof of this is in the public acceptance of a wide variety of distribution systems.

It is pretty well accepted that most people prefer some degree of stratification in the temperature distribution within the car. This means that the temperatures near the floor of the car are higher than those at the breathing level. The extent of stratification and the means for producing it vary widely in the industry.

Some manufacturers use a fixed type of distribution, which provides a certain amount of stratification. Others provide means for introducing unheated or heated air into the upper level of the car

Car Heater Designers

John T. Moren, Heating Engineer, Chrysler Corp.

Secretary's report of round table discussion on car heating and ventilating, held during SAE Summer Meeting, Atlantic City, June 8, 1954.

so that control may be exercised as to the degree of stratification.

One other advantage of the controlled stratified distribution lies in its usefulness during the defrosting or de-icing process. During snow conditions it is often advantageous to blow cool air across the windshield instead of warm air. The cool air will defog the windshield but will not melt the snow—thus allowing it to blow off the windshield surface.

Defrosting, Defogging, and De-icing

In today's heavy traffic a windshield that is coated with fog, frost, or ice is not only annoying, but extremely dangerous. The advent of the new wrap-around windshields emphasizes the problem of maintaining clear vision and offers an even greater challenge to the heating engineer.

These inconvenient and hazardous conditions of steam and frost can be pretty much eliminated by maintaining the glass temperature above the dew point of the air in direct contact with the inner glass surface. This is usually accomplished by directing a stream of tempered outside air across the windshield and side windows. Directing the discharge of defogging air over the windshield not only places the air of lowest moisture content in closest proximity to the glass; it also provides a "barrier" so that the highly humid breath air given off by the occupants will not reach the windshield. Obviously, the air must be heated and perhaps delivered in a higher concentration in front of the driver and passenger for good de-icing.

The air volume and velocity required for defrosting vary with climatic conditions, number of occupants, and driving conditions. However, defroster systems capable of delivering a minimum of 100 cfm at a discharge velocity of 1000 fpm with a temperature of 125 F are capable of doing an acceptable job. The defrosting system should be as quiet as possible and the temperature of the air should be subject to driver control to meet various driving conditions.

Infiltration

A car not equipped with a fresh-air heater will have an internal pressure less than atmospheric when the vehicle is driven, and the pressure differential will increase with the speed. This means that cold outside air will infiltrate into the car through body leakage paths. Naturally, this would upset the performance of the car heater—especially if the cold outside air were blowing directly on one of the occupants.

The action of a fresh-air heater in forcing outside air into the car tends to pressurize the interior of the car, thus preventing drafts through outside air infiltration. The extent of pressurization will depend on the quantity of outside air handled by the heater, the body sealing, car speed, and wind direction and velocity. It is interesting to note that if the body sealing were perfect, the heater would not

function because there could be no airflow through it. However, commercially sealed vehicle bodies normally offer sufficient exhaust openings for the outside air without adding special exhaust ports. So it should be remembered that pressurization is desirable, as well as sufficient airflow—and a good design compromise must be arrived at between the two.

It has been suggested that, with a reasonably well-built car body of today, an outside or fresh-air type of heater capable of delivering 150 cfm at 30 mph with an average discharge temperature of 130 F represents a combination of what is needed for a satisfactory heating system.

Odors and Noise

The advent of outside air heaters brought along an odor problem. Naturally, outside odors will be brought into the car through the heater, if they exist. These odors might include exhaust odors from other vehicles, odors from industry, and other city and country odors. It should also be noted that the fresh-air heater will clear the car of undesirable odors when they are drawn in, since the car air is continually being changed. The closing of the car in the winter also brings about a certain amount of internally created odors that will be absorbed and retained in the upholstery and trim material. These odors seem to remain despite large quanities of fresh air introduced through the heater.

Many discussions have been held as to whether some type of filtering system or activated carbon package should be used in the duct work entering the car. Undoubtedly, an effective filter could be built into modern heating systems; but it would require much maintenance since an effective filter will soon become clogged with the material it removes.

One of the most effective means for reducing outside odors lies in the proper design and location of the outside air intake. The trend in automobile heater design seems to be toward the cowl top intake.

The noises associated with the car heater are usually air noises or those caused by rotating motors, fans, and the like. The reduction or elimination of these noises can best be obtained through the proper design and sizing of ducts and nozzles, location of noise sources away from the passenger compartment, and effective balance specifications.

Power Requirements

The load imposed on the electrical system of the modern automobile has become quite large and, consequently, the load imposed by the heater and defroster must be studied very carefully for possible reductions. It was reported that the heating and defrosting load runs from 85 to 130 w, depending on the number and type of fans used in the installation.

Fresh-Air Intake Location

The acceptance of 100% fresh air for heating requires that consideration be given body design in providing an outside air inlet. Currently, there are three general locations used for both heating and ventilating:

1. Radiator grille air inlet.
2. Cowl side air inlet.
3. Cowl top air inlet.

The radiator grille air inlet, which is used to a large extent, requires relatively long ducts to carry the air to the passenger compartment. It does have an advantage in that the blower can be mounted where space is not at a premium. Also, with this arrangement water separation is seldom a problem.

The cowl side inlet requires shorter ducting and is effective in providing summer ventilation air.

The cowl top air inlet brings the air in as high above ground as practical, where road dust and exhaust fumes are at a minimum. It was pointed out that Nash engineers have used this type of intake since they began building fresh air heaters and that they have been well pleased with the results. A cowl top intake means that a provision must be made for separating water from the air. This is usually quite simple and is accomplished by changing the direction of airflow abruptly.

The air intake, regardless of location, should be as large as good styling will allow and the overall system restriction should be held as low as possible so that the airflow due to car movement will be a maximum.

Automatic Temperature Control

The variable conditions under which an automobile and automobile heater operate make some type of automatic temperature control a necessity to achieve a really comfortable condition. Heater capacity to meet varying loads is achieved in all cases by varying the flow of hot water through the heater core. The automatic temperature control currently used throughout the industry is essentially a thermostatically controlled water-flow valve connected in series with the heater core, which modulates flow about a manually selected position.

There are two methods used at present for sensing the needed heater output. In one method, a sensing element is placed in the heater discharge, thus automatically controlling the discharge air temperature. "Car control," the other method, places the sensing element primarily in the car passenger compartment and the heater output is regulated automatically to maintain a selected car temperature.

Summer Ventilation

Summer ventilation is a function usually closely allied with heating the car. In some designs the air for summer ventilation travels the same circuit as used for heating air. It is necessary in designs of this type that the duct, core, and fan restrictions be as low as possible to obtain sufficient air volume for summer ventilation. This presents a difficult situation since normally the minimum airflow required for summer ventilation is greater than the minimum flow for heating. In many installations, where the pressure differential is high, a second inlet and duct are used to supplement air for ventilation.

Heating and ventilating specialists agree that considerable work should be done in improving warm-weather ventilation, particularly at low-speed traffic driving.

Chrome-Steel Springs Endure Heat Best

. . . Tests prove certain alloys retain spring properties well up to 450 F—but shot peening doesn't help.

F. P. Zimmerli, Barnes Gibson Raymond Division, Associated Spring Corp
W. P. Wood, University of Michigan

Based on paper "The Effects of Temperature on the Endurance Limit and Relaxation of Spring Materials" presented before Division XX of SAE Iron and Steel Technical Committee, Hershey, Pa., Oct. 1, 1953. Complete paper will appear in 1954 SAE Transactions.

UNTIL recently, practically nothing was known of the fatigue characteristics of various spring materials at low and elevated temperatures. Likewise, little was known about what per cent of the beneficial effect of shot peening on spring fatigue life persists at elevated temperatures. A recent investigation of springs made from the following seven materials has provided some of the answers.

1. Pretempered carbon-steel wire
2. Pretempered chrome-vanadium-steel wire
3. Pretempered chrome-silicon-steel wire
4. Pretempered high-manganese-steel wire
5. Hard-drawn 18 chrome—8 nickel stainless-steel wire
6. Patented music wire
7. High-speed-steel wire

It was found that:

- Shot-peened springs have higher endurance limits at −75 F and 75 F than unpeened springs. Relaxation, however, is somewhat greater.
- As temperatures rise above atmospheric, the endurance limit of unpeened springs tends to hold steady or to increase somewhat. The endurance limit of shot-peened springs, on the other hand, shows a general downward trend.
- With the exception of high-speed steel and stainless steel, chrome-silicon steel springs give the lowest load loss or set in both static and dynamic tests in the temperature range from atmospheric to 450 F.
- High-speed-steel springs, both unpeened and shot peened, show surprisingly high endurance limits at all test temperatures.

Table 1 shows the chemical composition, mechanical properties, and preliminary treatments of the spring materials tested. All seven of the steels tested were in the form of helical springs.

A special fatigue-testing machine was used wherein the springs were subjected to 10,000,000 compressions in a heated chamber. (This corresponds to about 96 hr of running time.) The lowest temperature at which any tests were made was −75 F and the highest was 650 F. The majority of the tests were made in the range from 70 F to 450 F.

Endurance tests were made on all materials in

Table 1—Chemical Composition, Mechanical Properties, and Preliminary Treatment of Spring Steels

Type of Steel	Diam. of Wire in.	Tensile Strength psi	Rockwell C Hardness	Carbon %	Silicon %	Manganese %	Phosphorous %	Sulphur %	Chromium %	Vanadium %	Nickel %	Tungsten %	Preliminary Treatment: Shot-peened	Preliminary Treatment: Not Shot-peened
Carbon-Steel Valve Tempered	0.148	222,800	44–45	0.67	—	0.84	0.012	0.028	—	—	—	—	750 F for ½ hr Shot-peened ½ hr 450 F for ½ hr	750 F for ½ hr
Tempered Chrome-Vanadium	0.148	240,000	48–49	0.50	—	0.72	—	—	0.97	0.17	—	—	750 F for ½ hr Shot-peened ½ hr with cut-wire shot 450 F for ½ hr	750 F for ½ hr (Wire dia 0.142 in.)
Tempered Chrome-Silicon	0.135	245,249	49	0.60	1.48	0.79	0.012	0.021	0.60	—	—	—	750 F for ½ hr Shot-peened ½ hr 450 F for ½ hr	750 F for 1 hr
High-Manganese Valve	0.148	245,000	48	0.72	—	1.44	0.015	0.021	—	—	—	—	750 F for ½ hr Shot-peened ½ hr 450 F for ½ hr	750 F for ½ hr
18-8 Stainless	0.148	213,218	42	0.02	—	0.40 to 0.45	0.005 to 0.007	0.014 to 0.018	18.2 to 18.8	—	8.85 to 8.89	—	850 F for ½ hr Shot-peened ½ hr 450 F for ½ hr	850 F for ½ hr
High-Speed	0.148		52–53	0.70	0.35	0.25	0.004	0.012	3.76	1.20	0.07	16.09	Shot-peened ½ hr 450 F for ½ hr	No treatment, since heat-treated after coiling
Music Wire	0.148	259,000	45[a]	0.91	—	0.43	0.018	0.023	—	—	—	—	725 F for ½ hr Shot-peened ½ hr 450 F for ½ hr	750 F for ½ hr

[a] This hardness value was obtained on finished springs.

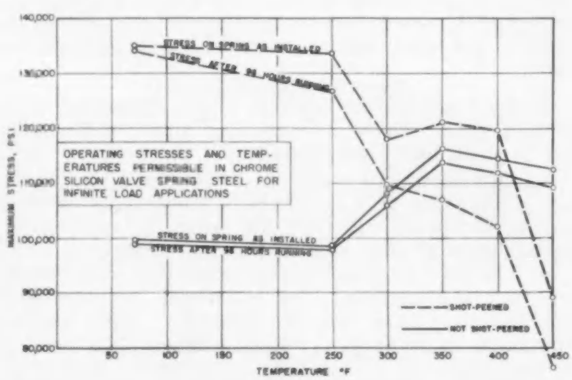


Fig. 1—As temperatures increase above atmospheric, the endurance limit of shot-peened chrome-silicon-steel helical springs approaches that of unpeened ones

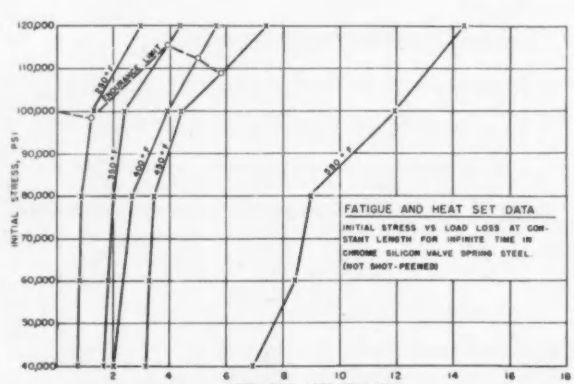


Fig. 2—This shows the loss in load-carrying capacity with temperature of unpeened chrome-silicon-steel helical springs

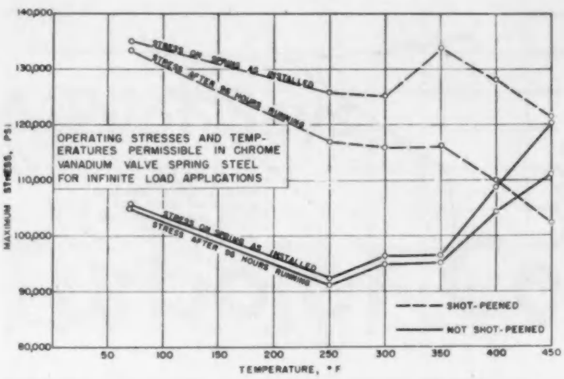


Fig. 3—Unpeened pretempered chrome-vanadium-steel helical springs have a higher endurance limit at 400 F than at atmospheric temperature

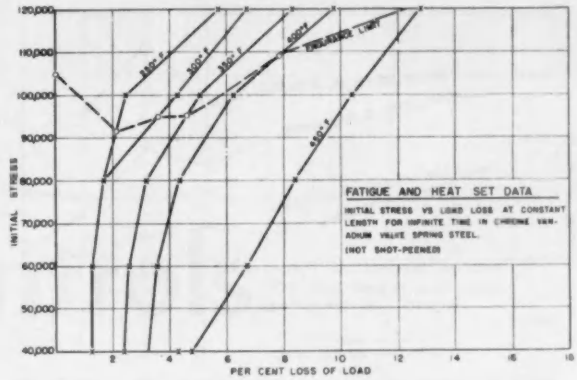


Fig. 4—This shows the loss in load-carrying capacity with temperature of unpeened chrome-vanadium-steel helical springs

both the shot-peened and unpeened condition. Relaxation tests were made only on unpeened springs.

The test results with five of the spring materials are shown in five sets of graphs, Figs. 1 to 10.

The first graph in each pair (Figs. 1, 3, 5, 7, and 9) shows the variation in endurance limit with temperature of the shot-peened and unpeened springs. In each case, the upper curve indicates the stress on the springs as installed (with modulus correction where necessary), while the lower curve represents the load loss in terms of stress after 10,000,000 compressions. The second graph in each pair (Figs. 2, 4, 6, 8, and 10) is a plot of static load losses, with endurance limit of the unpeened springs plotted on the same graph. This combination of data gives a useful picture of springs under heat and varying loads.

Note that as temperatures increase above atmospheric, the effect of shot peening becomes progressively less and the endurance limits of the shot-peened springs approach those of the corresponding unpeened ones. (See Figs. 1, 3, 5, 7, and 9.) It can also be seen that the unpeened pretempered wire springs have higher endurance limits at 400 F than at atmospheric temperature. (See Figs. 1 and 3.)

The endurance limits of the unpeened steels which were initially in a highly stressed condition (music wire and 18-8 stainless steel) show a slight downward trend, but at a lower rate than the same steels in the shot-peened condition. (See Figs. 5 and 7.) The 18-8 unpeened springs show a slightly higher endurance limit at 350 F than at room temperature.

Of the pretempered steels, chrome-silicon (Fig. 2) shows the lowest load losses on the average.

The 18-8 stainless steel did not sustain as high stresses as the other alloy steels, but, with the exception of high-speed steel, held up better in the range from 400 F to 600 F. (See Fig. 5.)

It was expected that the high-speed-steel springs would show some superiority to the others at elevated temperatures, but the results were well beyond expectations. (See Fig. 9.) Even at 650 F, the effect of the shot peening was still present and the endurance limit of the shot-peened springs was 130,000 psi. And the unpeened springs showed only

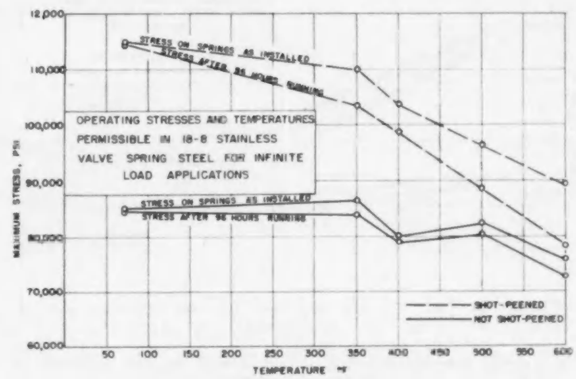


Fig. 5—Except for springs of high-speed steel, helical springs of 18-8 stainless steel held up better in the range from 400 to 600 F than springs made of other materials

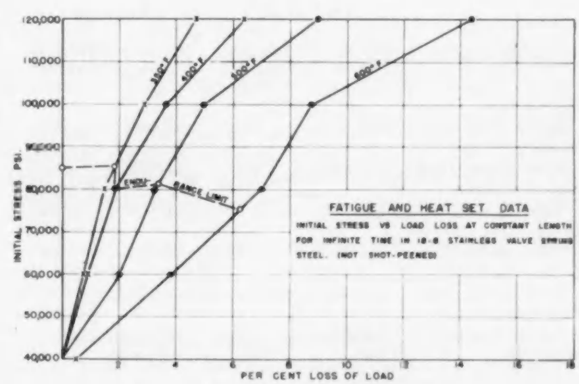


Fig. 6—This shows the loss in load-carrying capacity with temperature of unpeened 18-8 stainless steel helical springs

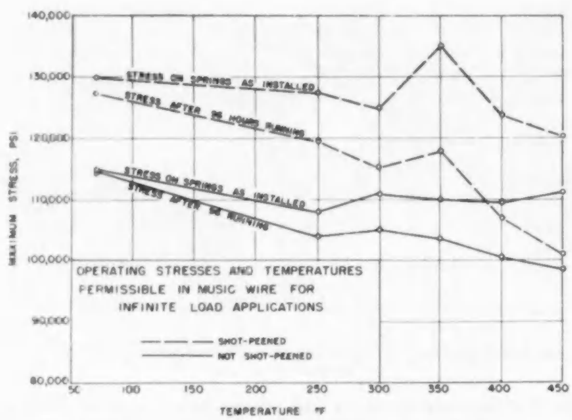


Fig. 7—The endurance limit of unpeened music-wire helical springs decreased at a slower rate with temperature than that of shot-peened springs

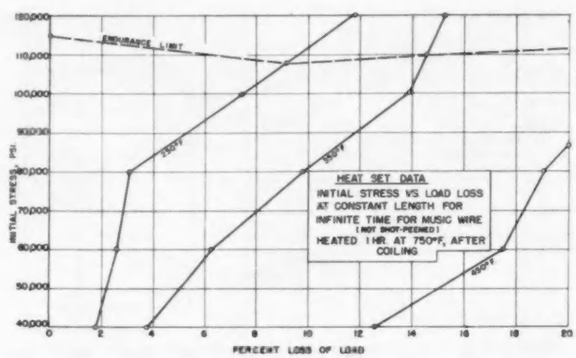


Fig. 8—This shows the loss in load-carrying capacity with temperature of unpeened music-wire helical springs

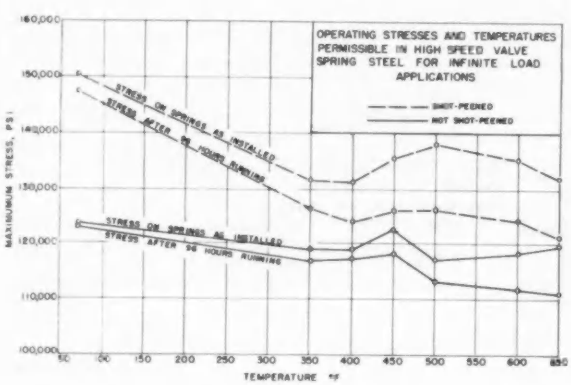


Fig. 9—High-speed-steel helical springs showed the best endurance at elevated temperatures

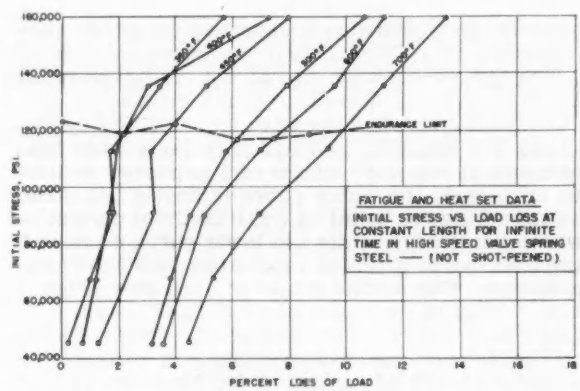


Fig. 10—This shows the loss in load-carrying capacity with temperature of unpeened high-speed-steel helical springs

Table 2—Endurance Run Results at - 75 F

Steel	Shot Peened: Maximum Stress psi	Shot Peened: Per cent loss of load	Unpeened: Maximum Stress psi	Unpeened: Per cent loss of load
Carbon Valve Spring Steel	135,000	1.0	95,000	<0.1
Chrome-Silicon Valve Spring Steel	135,000	<0.1	95,000	—
High-Manganese Valve Spring Steel	140,000	1.47	100,000	<0.1
18 Cr-8 Ni Stainless Valve Spring Steel	105,000	<0.6	85,000	<0.1
Chrome-Vanadium Valve Spring Steel	135,000	1.53	not run	—
High-Speed Valve Spring Steel	100,000	0.0	not run	—
Music Wire	not run	—	not run	—

a small drop in stress sustained at 650 F. The latter, in fact, gave some evidence that if a higher temperature could have been reached, the endurance limit would have increased, as was the case at lower temperatures for the springs made from pretempered wire.

Table 2 tabulates the results of endurance runs on the various steels as far as they were completed. In most cases, there is not much difference between the endurance limit at room temperature and at - 75 F. Undoubtedly the reheat-treated high-speed-steel shot-peened springs would have sustained a higher stress than 100,000 psi.

The most notable results of the low-temperature runs were the very small load losses recorded. No static load-loss tests were made at the low temperature, but it is believed that they would have indicated proportionally low losses.

The beneficial effect of shot peening was unchanged at this low temperature. This, coupled with the low load losses, would indicate more satisfactory performance of shot-peened springs at low temperatures than at atmospheric.

A Pilot Says

Turbojet Controls Are Too Complicated

Robert E. LaCroix, Supervising Engineer
Aviation Gas Turbine Division, Westinghouse Electric Corp.

Based on paper, "A Pilot's Viewpoint of Turbojet Control Requirements," presented at the SAE Annual Meeting, Detroit, Jan. 13, 1954.

TURBOJET planes would be easier and safer to handle—in the eyes of at least one pilot—if their complicated engine control system could be replaced by a simpler, more reliable type.

These simpler controls should combine *both* of the following functions:

- Complete control of engine power under normal conditions.
- Provision for safe operation of the engine during emergency conditions.

The point of the suggested system is that the controls would take over automatically in an emergency. It would thus differ radically from the present scheme, which includes independent emergency systems. These require the attention of the pilot at a time when he must necessarily be concerned mainly with things more critical than engine power.

Recommended System

One control system has actually been developed according to these principles.

Essentially, it consists of a simple, basic control system capable of safely operating the engine throughout the full range of the throttle lever travel, and which is trimmed to obtain the maximum performance in military and afterburning power settings. Engine rpm is controlled by governing the fuel flow, and engine temperature is controlled through variations in the exhaust nozzle area. The two systems are interlocked by the linkage to the common pilot throttle lever, as shown schematically in Fig. 1.

The fuel control system contains a controlling valve of proved reliability to provide a flow-scheduling regime by maintaining a fixed pressure drop across a manual throttle valve, a simple barometric acceleration control, and a flyball topping governor. The design incorporates the following features:

1. Maximum simplification consistent with the job to be done.

2. A high margin of safety of all components, particularly springs and small components.

3. The pressure-sensing bellows is so arranged that the highest pressure is on the outside. Thus, pressure will at all times tend to close any possible bellows rupture.

4. Stable valve design such that sticking of valves will tend to maintain an existing fuel flow that can be reduced by the manual throttle valve.

5. The rotating flyball governor has been proved highly reliable by extensive past usage. It is highly insensitive to dirt because of its rotation.

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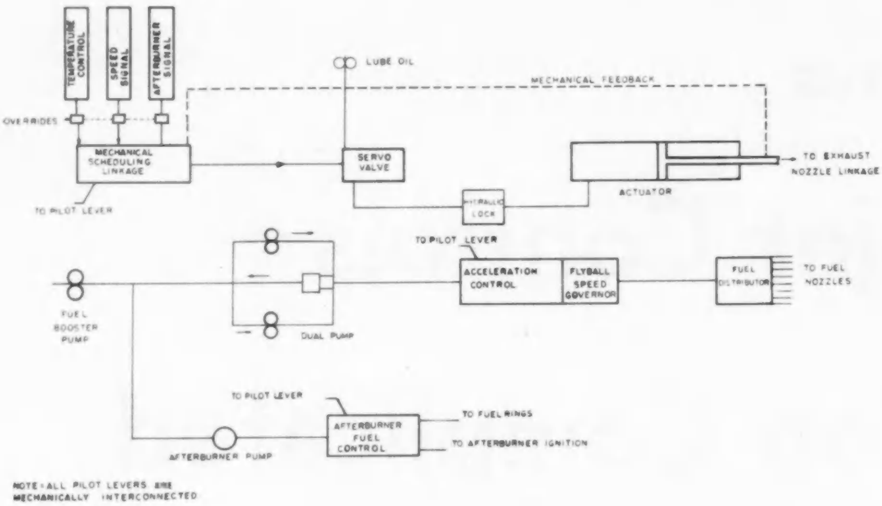


Fig. 1—Schematic diagram for control system of turbojet engine with afterburning and variable area exhaust nozzle

The exhaust nozzle actuator control system is composed of a mechanical scheduling control, which directly strokes a pilot valve controlling the admission of high-pressure oil to the exhaust nozzle actuator. A mechanical feedback completes the servo-loop to neutralize the pilot valve.

The actuator control, containing a linkage computor, converts power lever angle into exhaust nozzle position, subject to overrides for low engine rpm and afterburning, and subject to change by an automatic temperature control. The throttle-area relationship is shown in Fig. 2. Line ABCDEF represents the basic hot-day schedule of the computor. An underspeed condition maintains the area at ABB′ until the speed is on schedule and the control takes over. Temperature trimming closes the nozzle beyond the hot-day area (CD) to area GH or, in afterburning, to area JK. Until afterburning is actually in operation, area CDD′ is maintained.

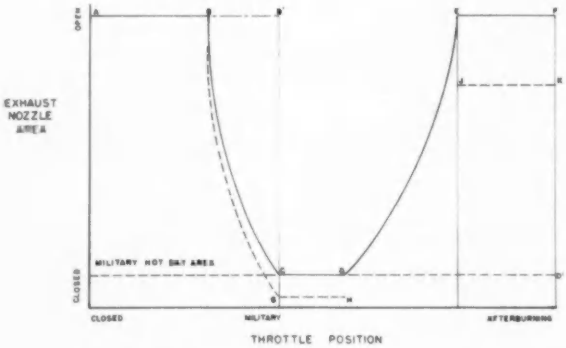


Fig. 2—Turbojet-engine exhaust nozzle area schedule

The system is designed to incorporate the maximum of reliability and fail-safe features. The pilot may, at any time, erase all trimming functions by disconnecting the electrical power to simulate manually a loss of power. Thus, regardless of electrical or other malfunctions of the trimming circuitry, the pilot still has a basic system available to give him good basic control, which will provide any degree of power from idle to afterburning he may select. It is so arranged that, in case of electrical or other failure, the pilot can continue take-off and fly for an indefinite period of time without endangering the aircraft. The fuel and exhaust nozzle control systems are coordinated at all times through the same pilot lever so that no consideration is required on the pilot's part other than controlling his acceleration rate during emergency operation.

It is felt that this system provides a better approach to the general control problem than those used heretofore. A considerable amount of additional work is needed, however, to make the individual components simpler and cheaper. Dirt in the fuel, if sufficiently concentrated, can limit fuel flow to that rate actually held at the time of the failure. Obviously, the pilot can continue to fly, but if he is at high altitude at the time of failure, he will lose power as he decreases altitude. All in all, the system represents a definite attempt to provide the pilot with a reliable system unencumbered by complicated emergency control systems and that is relatively easy to break down for maintenance purposes.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Radiography Becoming Production Tool

James H. Bly, X-Ray, Inc.

Based on paper "Non-Destructive Testing by Radiography" presented at SAE Summer Meeting, Atlantic City, June 9, 1954.

RADIOGRAPHY is the best non-destructive test method in some cases; in others it is definitely not. It has its limitations. As a method, it does not lend itself ordinarily to examination of microscopically fine structure. Furthermore, the minimum detectable thickness variation generally will be from one to a few percent of the thickness of the object.

Another geometric limitation can be made apparent by reference to Fig. 1. If it is assumed that there exists in the object a thin, flat discontinuity, such as a crack, so oriented that radiation may pass along one of its longer dimensions (its depth), its shadow might be expected to be recorded readily.

But if such a planar discontinuity were oriented parallel to the film plane so that radiation passed through only its shortest dimension, a record could be expected only if this "width" were at least a few percent of the total thickness. In engineering materials cracks may occur whose width is nowhere near so great. Accordingly, some such defects may be missed by the method, making advisable more than one exposure of the object, irradiating it from different directions.

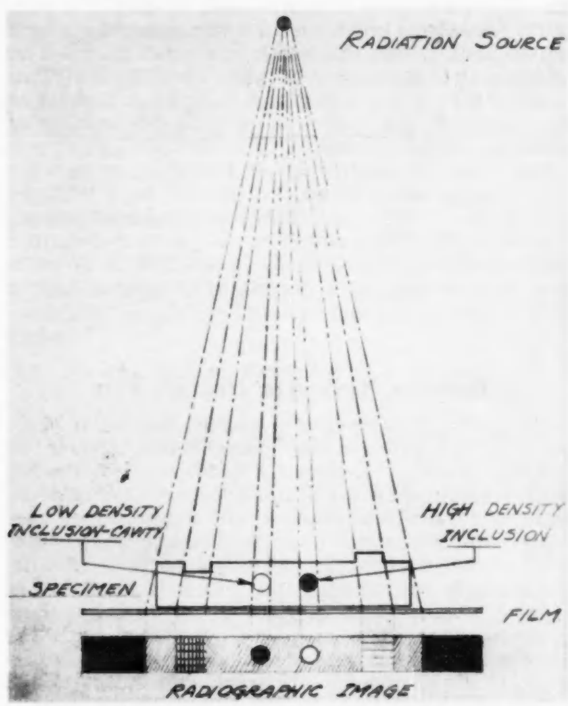


Fig. 1—This diagram of elements of radiographic set-up and process illustrates this single crucial fact of radiography: The absorption of x-rays or gamma-rays in materials is an increasing function of absorber thickness and density

Many Radiation Sources

There are many radiation sources available for radiography. Thus, a material-and-thickness combination on which the method is hopelessly impractical with one source may be capable of easy investigation with another. With respect to x-ray

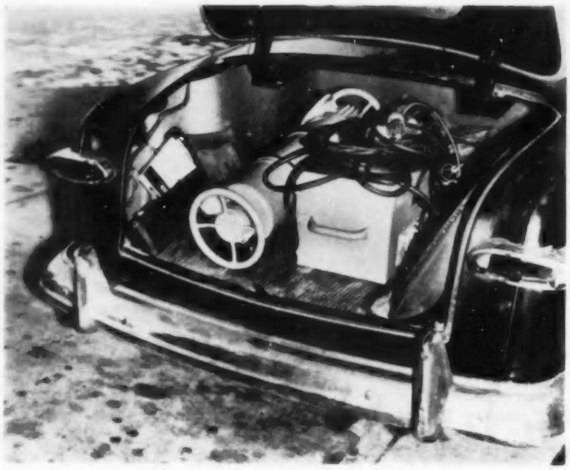


Fig. 2—Taking the x-ray equipment to the job is easy with this new portable 160-kv unit. It makes possible radiography independent of power line restrictions (Courtesy North American Philips Co., Inc.)

generators, one may have practically any energy range he can pay for, from 5000 to 31 million volts. He can inspect, using the proper source, practically anything from a grain of wheat to a steel casting about two feet thick.

In the lower range energy (300 kv and less) a great deal of development has aimed at reducing the size and weight of equipment. Today, it is perfectly feasible to buy a useful x-ray generator which can be packed into the trunk of a small car, and be powered by a portable generator. (See Fig. 2.) This permits taking the x-ray unit to the job instead of vice versa. It also makes equipment independent of power line restrictions.

The simple transformer or transformer-rectifier is no longer the only way to get the high voltages necessary. There are transformer-rectifier-condenser combinations which apply constant-potential (almost d-c) voltages of up to 250-300 kv to suitable x-ray tubes, as a means of obtaining higher efficiency of x-ray production.

Gamma Rays Are Useful, Too

The field of gamma-ray sources has been similarly, though perhaps less spectacularly, active. Of the hundreds of artificially radioactive materials made available by the Atomic Energy Commission, two that have already carved out wide fields of usefulness in radiography are cobalt 60 and iridium 192. Both are generally much less expensive than radium, particularly the iridium 192, which is available in sources of very high intensity at reasonable prices.

There are certain problems associated with the use of gamma rays that are usually mitigated somewhat if x-ray sources are used. Foremost is the safety problem. Radioactive sources must be handled only by highly trained and qualified personnel so as to avoid undue exposure of personnel to radiation. Gamma-ray sources are usually of much lower intensity than x-ray sources, so that exposures run longer. This may limit work performed within a given time unless multiple sources of high intensity are available. When this is the case, safety problems are multiplied. For many types of work, however given the proper sources, a gamma-ray crew can turn out an astonishingly large quantity of high-quality radiography in a day.

Maximum Thickness Varies

The maximum thickness which can be explored by radiography depends, in the individual case, upon the radiation which is available and other factors. Degree of irregularity of shape and variation in thickness of the specimens to be tested are two such factors. When there is a large variation in thickness within a single part, or when the part is very complicated in shape, scattering becomes a serious problem. It may make difficult or impossible an inspection of high sensitivity, even though the actual thickness of the material is within the range of capacity of the available radiation sources.

Metallurgical discontinuities of distinctly macroscopic size and highly various orientation may occur in castings and welds. That's why they offer a promising field for radiography testing. On the other hand, the method has only limited applicability for wrought materials because most of the discontinuities which can occur are either too small or too tightly closed for detection.

There are many instances where silver brazed joints in small parts are amenable to radiographic checking to detect voids as well as the total coverage of the joints. But in copper brazing, it is rare to find a type of joint to which the method may be applied.

Joins Production Line

Radiography will undoubtedly continue to expand as a method for catching parts which might make a customer unhappy. But the ferment in the field now centers on developing the method as a production tool. Today, there are hundreds of foundries which rarely sell an "x-ray required" casting, yet they use radiography routinely to establish casting practice and/or as a spot check to maintain quality. The most important development for the future will be the gradually emerging dominance of radiography as a production tool, rather than as a mere screening method.

Coincidental with this will come other advances. Film, which is a wonderful recording medium, is fairly expensive. Now, research is being focused on reducing its cost and replacing it with some other recording method. There are three potential replacements: the fluorescent screen ("Fluoroscopy"), the semi-conducting plate ("Xeroradiography"), and electric means of pick-up, recording, and even amplification of the information now made available by the film. None of these methods is ready for large-scale replacement of film, but all show possibilities.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Troubles With Cold Extrusion May Be Traced to Lubrication

J. F. Leland and J. W. Helms, Parker Rust Proof Co.

Based on paper "Influence of Proper Lubrication on Design of Cold-Extruded Components" presented at the SAE National Passenger-Car, Body, and Materials Meeting, Detroit, March 3, 1954.

SUCCESS with the cold-extrusion process depends in large measure, on proper lubrication. Proper lubrication, in turn, depends on the application of a suitable coating between the lubricant and the metal.

Originally, the coating was metallic (lead, copper, or tin). These metallic coatings were soon displaced by phosphate coatings because the latter:

- Can better withstand the extreme temperatures and unit pressures developed as a result of the severe metal deformation.

- Are easier to apply and to remove.

Of prime importance in obtaining a high-quality phosphate coating is proper preparation of the metal surface to be coated. To obtain a uniform etch and phosphate coating growth on the base metal, there must be complete removal of scale, surface oxides, grease, and soil. If not completely removed, brittle and abrasive oxides and surface scales flake off during severe deformation. This exposes bare metal and contributes to excessive tool wear and press down-time.

The coating and lubricating cycle for a production facility is usually carried on in automatic equipment of the indexing type similar to automatic platers or in specially designed equipment utilizing an automatic continuous conveying system. (See Fig. 1) However, in the development stage of an extrusion project it is of definite advantage to have available a series of properly designed immersion tanks complete with monorail, hoist, and trunnion basket. Such an arrangement provides the greatest flexibility in working out optimum time cycles, particularly in cleaning, which will vary with the condition of the raw stock, annealing cycle employed, and the type of soil present.

One recommended coating and lubricating cycle is as follows:

1. Alkali cleaning.
2. Water rinse.
3. Acid pickle.
4. Cold water rinse.
5. Hot water rinse.
6. Bonderite (phosphate coating bath).
7. Water rinse.
8. Parcolene rinse.
9. Bonderlube (reactive lubricant bath).

In the order in which they appear above, a few pertinent remarks are advisable regarding each stage:

1. Alkali cleaning: Operated at a temperature of 160 to 200 F, this stage may be either immersion (5 to 10 min) or spray (1 to 2 min). A spray unit is obviously more efficient and requires less time, due to the mechanical action of the sprays, if properly directed onto all surfaces of the work. In this stage all oil, grease, and soil from previous operations must be thoroughly removed so that subsequent pickling will be effective over the entire surface area.

2. Water rinse: This stage is usually operated hot and overflowing by immersion or spray. Residual alkali must be completely removed to prevent neutralization of the pickling solution.

3. Acid pickle: This stage may be immersion (5 to 15 min) or spray (2 to 5 min). In most commercial applications a 10% (by volume) solution of

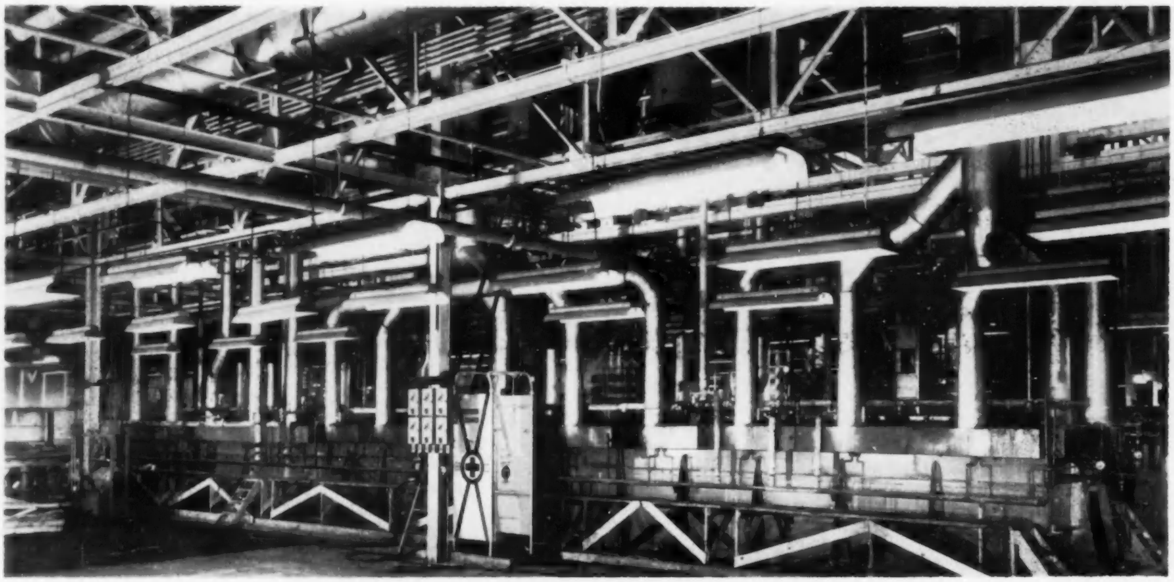


Fig. 1—Automatic equipment for application of phosphate coating and reactive lubricant

sulfuric acid is used and operated at temperatures from 140–180 F. Normally, spray pickling, if properly operated, is considered twice as fast as immersion pickling and allows more effective use of acid. Counterbalancing these advantages are the high initial cost of spray picklers and the greater amount of maintenance required. The wide range in the time cycle as listed above is dictated by the variety of scale conditions encountered in the various operations.

Experience has proved the error in attempting to eliminate pickling by employing bright annealing operations. A certain amount of etch on the base metal is helpful in the actual extrusion operation as well as in obtaining an optimum lubricating system. On the other hand, the use of an atmospheric controlled furnace has been found to be of distinct advantage in reducing pickling time, lowering acid consumption, and minimizing the problem of waste acid disposal.

4. and 5. Water rinses: These stages may be immersion or spray and of approximately ½–1-min duration each. From a practical standpoint, two rinses are used at this point to assure complete removal of residual pickling acid and of the iron resulting from the pickling action. The first of these rinses is usually of short duration, operated cold and heavily overflowed to remove most of the residual pickling acid, while the second rinse is operated at a temperature of approximately 160 F to raise the temperature of the workpiece and assure complete rinsing.

6. Bonderite (phosphate coating bath): This stage is immersion and operated at from 160–200 F. Immersion time varies from 3 to 7 min. In this bath an acid zinc phosphate reacts with the surface metal to produce a nonmetallic gray crystalline zinc phosphate coating integral with the base metal and blotter-like in nature.

It should be noted here that coating weight (generally stated in milligrams per square foot) is not necessarily the criterion by which such coatings can be judged. As previously stated, the phosphate coating in itself is not a lubricant but acts as a carrier for the lubricant and by chemical reaction with the lubricant renders it virtually integral with the metal surface.

7. Cold water rinse: This stage may be operated spray (½ min) or immersion (1 min), heavily overflowed. This rinse serves the purpose of removing the major portion of the residual acids and acid salts from the coating solution.

8. Parcolene 20 rinse: Final rinsing in this stage by spray or immersion (½ to 1 min) is carried out in a well-buffered neutralizing medium, which must be compatible with the lubricant being used. The remaining residual acid and acid salts in the porous coating must be neutralized at this point so that adsorption of, and reaction with, the lubricant is complete.

9. Bonderlube 235 (reactive lubricant bath): This stage is operated at 140–160 F with an immersion time of 3–7 min. The bath consists of a dilute soap solution which, in a controlled reaction, combines with the zinc phosphate coating to form a water-insoluble metal soap, zinc stearate. The lubricant layer thus formed has a high degree of lubricity and maintains its antiflux properties even under the high unit pressures (up to 300,000 psi) and high, short-interval temperatures (up to 450 F) developed in cold extrusion.

On straight ironing operations such as tube drawing and cartridge case manufacture a regular high

titre sodium soap may be used effectively, but here again the reactive-type lubricant can offer extra dividends. Properly applied, reactive lubricants permit two or more cold reductions in many cases without the necessity for annealing and relubricating between operations.

While the description of this procedure may seem somewhat complex, it should be noted that it involves the addition of only two extra stages to what is normally considered good cleaning, pickling, and lubrication practice in cold drawing.

Although extreme-pressure lubricants can be employed on development work on light extrusions, the above sequence of coating and lubricating can, in many instances, present a different picture as to the practicality of the extrusion in question. In other words, it is frequently thought that the main purpose in applying the above lubricant sequence is to obtain longer die life by reducing wear and that it therefore is unnecessary on experimental setups. Actually, a properly applied and suitable lubricant system can, by compensation, be the difference between failure and success, encouraging further refinements in design or tooling to produce eventually a practical application of forward or backward extrusion.

Extrusion tonnages can literally be doubled with improper lubrication and the corresponding increase in unit pressure on the already highly stressed tools may well lead to tool failure, resulting in costly shutdowns and expensive replacements. Then too, the optimum in lubrication is desired in the development stage so that the ultimate in cold work can be accomplished in each step, thus eliminating extra operations and the attendant tools, anneals, and handling. It may, therefore, also be pointed out that the further the designer finds it necessary to deviate from best-known cold-forming practice to obtain given shapes or physicals, the more important the lubricant becomes.

(Paper on which this abridgment is based is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Designers Can Prevent . . .

. . . illogical tolerances by reviewing specifications with quality control men. Lower productions costs and better quality both may result.

Based on a Production Forum Secretary's Report by **Richard H. Ede,** United States Steel Co.

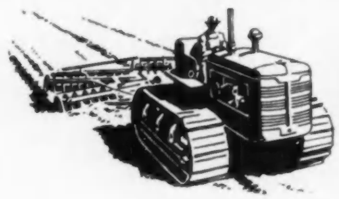
THE quality of a product is established by its design. But the cost of illogical tolerances can be high. Manufacturers whose designers have not reviewed specifications with their quality control engineers or statisticians are missing a chance to lower production costs.

Gains in quality and cuts in manufacturing costs both can result from design engineers using the knowledge furnished by a study of frequency distributions in setting tolerances for critical dimensions. Without this information, tolerances are generally set too close because of a tendency to include "safety factors" in many specifications. This habit presents the production department with the unhappy choice of violating the specification limits or of operating at an uneconomic level.

Particularly disturbing is the misconception that tolerances are additive. Actually, cancellations are terrific in combining tolerances in an assembly operation. The chance of drawing at random a combination of pieces all on the high side of the tolerance limit for each piece is extremely remote. That's because frequency distributions are overlapping. Quality control can predict the actual combined tolerances needed in such situations and experience has proved the accuracy of these predictions. In one specific case, for example, combined tolerances totalled ± 0.330 but combined working tolerances of ± 0.082 were sufficient to avoid any trouble in the assembly of the material.

Quality control will present the true picture in the matter of setting specifications. It is a matter of record that more tolerances have been loosened than tightened after these principles have been applied. In either case, the cost of illogical tolerances is high.

(The full secretary's report of which this article is an abridgment is available as SP-306 along with reports of the seven other Production Forum panels at the 1954 SAE National Production Meeting held in Chicago on March 29, 1954. Chairman of this panel was F. J. Dalton, Deere & Co. Members were L. A. Knowler, State University of Iowa; A. C. Richmond, International Harvester Co.; Arthur Bender, Jr., Delco-Remy Division, GMC; and W. E. Jones, Management Controls.)



Tractor Meeting Engineers Look More to

TODAY's "new look" in tractors and farm machinery will be the "old look" tomorrow. That's because the men who engineer these machines have latched on to scientific methods and instrumentation which promise new highs in performance, safety, and operating economy.

The fresh approach to design of machines that work the soil permeated all the technical sessions at the SAE National Tractor Meeting, September 14–16, at Milwaukee. The nearly 1500 engineers at the Meeting (a record-high attendance) came to exchange ideas on the newly evolving "scientific design."

Discussions bristled with new development and testing methods that hurdle the technical barriers of yesterday. Power steering, variable speed drives, hydraulic transmissions, and integrated tractors are just a few of the products the new approach already has yielded.

More are on the way, and here's what's back of it: Farm equipment and earthmoving machinery engineers found that the basic knowledge in their field was becoming inadequate to produce needed product advances. As has happened in other technical areas, tools for predicting behavior of materials and machines were becoming obsolete. Engineers in the farm and earthmoving machinery business decided to do something about this. The results, disclosed at the Meeting, presage a revolution.

Heed Changing Farm Economics

Engineers are gearing their scientific approach to the changing needs of their customers. The farmer is an important one. Caught in a cost squeeze he now is looking for ways to lower his unit costs. He'll find ways to buy machines that will cut his operating costs. Here's what he is up against:

1. Farms are getting bigger, but fewer in number. So the farmer will want even more flexible tractors.

2. Farm help is decreasing, but going up in cost. That's forcing farmers to go to larger tractors.

3. Because he can't control peak work loads created by weather and pestilence, the farmer wants machines with dependability and reserve capacity. That's so he can work at night or around the clock if need be.

4. No longer will farmers be able to increase acreage to feed a growing population. So added production must come from increased yield per acre.

5. The farmer needs more time to devote to the business end of his operation. Machines will have to take more of the load of working the fields. And because manpower is such a precious commodity, the farmer can't afford accidents, particularly on one-man farms.

New mechanical advances already are being introduced to satisfy these current farm needs. For example, tractor engineers have borrowed a leaf out of the passenger car engineer's book by adapting power steering to the wheel tractor. Power steering is a natural on tractors for several reasons.

First, growing use of heavier and larger front-mounted implements hampered conventional steering. Giving steering a power assist opens a new field for front-mounted implements. Second, high productivity per operator is possible now that he is able to master his tractor with power steering rather than fight it. Third, the operator can steer with one hand. It leaves him free to operate the many other tractor controls.

Safety Gets a Lift

Another design trend is the shift toward cabs for heavy-duty tractors. On the farm and on construction jobs, cab-equipped tractors are racking up impressive safety records. Contractors, insurance companies, government agencies, and state highway departments have figures to support the claim that cabs curb injuries and fatalities.

Judging by discussions at the Meeting, the present is but a prologue to the future. New researches

Highlights:

Science to Revamp Earthworking Machines

and investigations into behavior of earth-working machines promise even greater advances to satisfy user needs.

Irradiated Gears Bare Wear Habits

For instance, engineers are now relying on radioactive tracers to measure gear wear. By irradiating test gears in a nuclear reactor, engineers can check the gears under many operating conditions in a fraction of the time it used to take. Measuring radioactivity of worn iron particles in the gear oil gives them a sensitive wear yardstick. This research tool augurs well for more durable, better performing tractor gears.

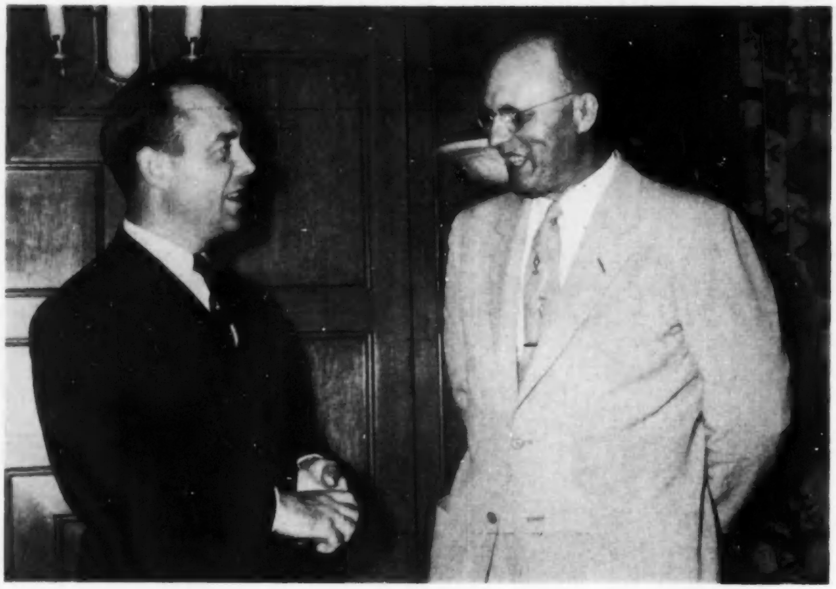
New horizons were predicted for tractor engines. Two researchers who tested an experimental gasoline engine built by Oliver Corp. had this to say: "A tractor engine integrating many of the present passenger car engine design features (high volumetric efficiency, low friction—high compression ratios) is practical. It can provide similar gains in power and economy, and fuel antiknock utilization."

This experimental engine was operated at 7, 9.5,

Dinner Participants

These men played an important part in the success of the Meeting. They are (left to right): Arnold Meyer, general chairman of the Meeting; Dr. Henry J. Gomberg, dinner speaker; and R. L. Switzer, chairman of SAE Milwaukee Section which played host to the Meeting

Happy Harvest



Success of the Meeting, and the technical sessions in particular, brought smiles to the faces of H. L. Brock (left), vice president for the SAE Tractor and Farm Machinery Activity, and Merlin Hansen, meetings vice chairman of the same activity committee

and 12 to 1 compression ratios. The 9.5 and 12 to 1 ratios showed a 12.3% and 17.85% gain respectively in power and fuel economy over the 7:1 ratio. Operated in a tractor chassis, this experimental engine started easily and performed smoothly. It brought no operational problems at compression ratios up to 12 to 1.

Farm tractor tires also are getting pretty intensive study, according to reports at the Meeting. Right now the Tire Subcommittee of the SAE Tractor Technical Committee is in the midst of a tire evaluation program. Aim: to determine the feasibility of several tire series such that the basic tire and at least two oversizes in each series shall have common overall diameters and rolling radii.

This tire performance program depends on extensive field tests. And the field investigations call for pretty complex instrumentation . . . strain gages to serve as load-measuring devices, torque measuring instruments, electrical distance-measuring devices, electric tachometer, and instrumentation for recording all the information.

Tests Telescope Time

Equally impressive field testing is under way to improve the structural strength of farm machines. Strain gage equipment has been put to work measuring dynamic loads of machine members in test track operation. The same failures observed on the test track eventually show up in the field. So testing proves helpful by revealing weaknesses in a machine in the early development stages. And engineers figure that test track operations accelerate their investigation 10 to 20 times over field observations.

Following are highlights from the technical papers presented at the Meeting, which will be handled in more detail in subsequent issues of the Journal. Complete copies of each paper are available in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 65¢ to nonmembers.

Cabs Pay For Themselves

A survey of tractor dealers, insurance companies, Army engineers, labor unions, and State Labor Departments found that almost all were in favor of cabs on heavy duty tractors. Well-designed cabs not only protect the driver from the elements, but more than repay initial costs by reducing accident injuries and increasing productivity from the driver. The tractor with a protective and comfortable cab will be in use more hours per year than an open tractor. . .

. . . **John C. Enblom, Crenlo, Inc.,** "Heavy Duty Tractor Cabs."

Power Steering For Tractors

The use of power steering on tractors will permit new front mounted implements to be designed, allow the operator to steer with one hand, (thereby leaving the other hand free to operate other controls) and reduce physical effort and fatigue of the driver. Through field experience and test data the following design specifications have been arrived at: (1) 43 deg per sec steering rate on the steering spindle is adequate for most operating conditions, (2) 4 to 5 lb force to turn the steering wheel was found to be most desirable, (3) a compromise must be reached between lower steering ratios

and what drivers have been accustomed to, (4) manual steering control is retained to steer while the engine is not running, (5) durability and service free operation require the simplest possible design. . .
. . . **C. Hess, L. Ethington, and R. Giertz, John Deere Waterloo Tractor Works,** "Adaptation of Power Steering To A Line of Agricultural Wheel Tractors."

Hydrostatic Transmission Increasing

Hydrostatic transmission, heretofore popular in the machine tool and aircraft industries, is being used in earth-moving equipment. It is considerably more efficient than hydromatic and mechanical transmission for some uses. One important advantage is its extreme flexibility in installation. Another is its precise control of speed and travel.
. . . **H. V. Parsley, International Harvester Co.,** "Hydrostatic Transmission in Earth Moving Equipment."

Instruments For Tire Tests

The selection of instruments for testing farm equipment in the field involves many factors including: (1) objective and scope of test, (2) quality and quantity of data required, (3) conditions under which tests are to be conducted, (4) space available for instrumentation.

The basic information to determine tire performance is (1) work input to the tire, (2) work output from the tire, (3) dynamic weight acting on the tire.
. . . **F. C. Walters and J. K. Jensen, John Deere Waterloo Tractor Works,** "Instrumentation For Evaluating The Operating Performance of Farm Tractor Tires."

Tool Bars Functional Design

The crawler tractor tool bar didn't just happen. It is the result of careful investigation and is designed so that (1) during pushing or pulling full engine power can be used, (2) during lifting or depressing there is high tractor stability, (3) tools can be changed easily and quickly by one man, (4) tool attachments do not interfere with the belt pulley, power take-off, drawbar, or auxiliary power devices, (5) operator has maximum comfort and visibility, and (6) there is no change in top or bottom clearance, and small change in side clearance. . .
. . . **F. P. Hanson, Caterpillar Tractor Co.,** "Tool Bars Power Controlled, Standardized Harness For Integral Equipment On Crawler Tractors."

Reducing Seat Vibration

Mathematical calculations, which were later verified by experiment, show that a tractor driver will bounce at least as high as the obstacle over which the tractor is riding. Sometimes he will bounce two or three times higher, depending upon the coupling between the seat and the tractor.

If there is insufficient space to allow enough seat deflection to prevent "bottoming," the seat suspension should be replaced by a rigid seat with carefully designed padding.

A low back rest, built up to the

Past President and Nominee

SAE Past-President C. E. Frudden (left) introduced C. G. A. Rosen as SAE presidential nominee for 1955. Rosen was toastmaster at the dinner

New Jobs Ahead For Atomic Energy

Power generation, coupled with byproduct uses, assures **a lusty future for nuclear energy** in peacetime applications. That's what dinner speaker Dr. Henry J. Gomberg predicted at the Meeting.

Gomberg, assistant director of the Michigan Memorial-Phoenix Project, of the University of Michigan, said that uranium will **extend our power fuel supply.** There's 20 times more energy available from uranium and plutonium than from known coal supplies.

The **real shot in the arm** for the atom-for-power use was the breeder reactor. This device permits you to burn nuclear fuel and end up with more than you started. It's much like putting a shovel of coal and several shovels of stone in your furnace at the beginning of the winter, heating your house all season, and winding up with a furnace full of coal.

Byproduct radioactivity, up to now a waste in uranium and plutonium production, also shows possibilities. For instance, irradiating pork can rid the meat of trichnosis. The rays render the trichnosis worm sterile so that it can't continue to reproduce. **Irradiating other foods** (such as meats, vegetables, and dairy products) extends their storage periods.

Gomberg also told of an experiment in which a cylinder was irradiated and placed into a propane-burning nozzle. The gas going through the nozzle was ionized by the irradiated cylinder. Result: a 15% boost in specific thrust. Gomberg feels that this may point the way to a method of **increasing the fuel-handling ability** of such fuel-burning devices.

We're **hindered in developing peacetime atomic uses** because we're backing into it, said Gomberg. The A-bomb came first; industrial and medical applications are just offshoots of the military use. It's as if the first use of gasoline were for napalm fire bombs, and then someone had to convince industry that gasoline might be worth trying in other applications . . . like powering vehicles and aircraft.

Whenever man has gained control of a new energy form, he has brought about drastic changes. "Let's hope we can learn to live with atomic energy before it takes us apart," concluded Dr. Gomberg.

height of the pelvis, seems to be the most favorable design for tractor seats. . . . **Dr. I. M. Haack, Institute for Tractor Research, Braunschweig-Volkenrode,** "Tractor Seat Suspensions For Easy Riding."

Gear Wear by Geiger Counter

The rate of gear wear can be determined by using radioactive tracers. The gear which is to be tested is made radioactive by exposing it to a nuclear reactor pile. Then the amount of metal particles worn off in use is measured by a Geiger counter. By using suitable test controls it is possible to detect wear as low as 50 micrograms per minute by this new method. . . . **F. L. Schwartz and R. H. Eaton, Engineering Research Institute, University of Michigan,** "Wear Rates of Gears by the Radioactive Method."

Designing V-Belt Drives

Designing adjustable speed V-belt drives used to be a complicated trial and error method. Now it's possible to calculate by formulae the best possible compromise between speed variation, power transmission, and service life. This type of belt drive has been used on harvesting machines such as combines and cornpickers, however it is adaptable for many other types of machines. . .
. . . **W. S. Worley, Gates Rubber Co.,** "Designing Adjustable Speed V-belt Drives for Farm Implements"

Earthmoving Tires Versatile

Durability, traction, flotation, rolling resistance and heat of large off-the-road tires vary with the kind of service the tire is subjected to. The earthmover tire must be designed to operate well under various conditions. Three common types of tire design are the rock, the traction, and the overall pattern. . .
. . . **C. W. Moss, Goodyear Tire and Rubber Co.,** "Performance Characteristics of Large Off-The-Road Tires."

Testing Farm Machinery

Agricultural machinery should be tested on the proving ground just like other automotive machinery. Generally failures will show up on a test track that eventually happen in the field. Designers should purposely design their prototype models lighter than standard and then strengthen weak points as they show up during

tests. This is because it is seldom possible to reduce the size of a structural member after it has been designed. . .
. . . **W. J. Cox, Massey-Harris Co. Ltd., Toronto,** "Proving Agricultural Machinery on a Test Track."

Tractor Engine Design

Many of the present passenger car engine design features, such as high volumetric efficiency, and low friction-high compression ratios will provide similar gains in power and economy if used in tractor engine designs. As far as ease of starting, flexibility and smoothness are concerned there are no operational problems which limit the use of compression ratios up to 12:1.

In order to get the maximum fuel quality utilization it is necessary to design tractor engines which fully exploit fuel sensitivity. . .
. . . **H. T. Mueller and R. E. Gish, Ethyl Corporation,** "Tractor Engine Design Requirements For Best Fuel Utilization."

Engine Standardization

Co-operation between the automotive industry and the military has made it possible to go a long way towards standardizing engines and accessories for military use. Where previously there were 1827 different models of major engine parts, there are now only 165—a 90% reduction of high mortality parts in the 2 to 6-in. bore range. In many cases engines using standardized parts performed better than they did with the original parts. . .
. . . **J. H. Horton, Engineer Research and Development Laboratories, Fort Belvoir, Virginia,** "Standardization Of Military Industrial Engines."

Variable Speed Drives

A combine using a variable speed drive harvested 37 acres of wheat in 8½ hr, over extremely hilly fields and washouts. A similar machine without the drive wouldn't have harvested over 20 acres in that time without becoming damaged.

On smooth, hard ground, with no washouts over 60 acres were harvested in 12 running hours, threshing 1100 bushels of wheat. There was never a stop to change gears, operators, or to unload the grain tank. . .
. . . **J. R. Thomas, Thomas Hydraulic Speed Controls, Inc.,** "Variable Speed Drives For Agricultural Machinery."

Around the Meeting . . .

Here is how a designer decides on what the tolerance on a dimension should be, observed **E. L. Fay,** of Deere and Co., leader of the Inspection Panel: First the designer says the tolerance should be "X"—or $T=X$. After he sleeps on it, he says maybe it's too tight, so he changes it to $T=X+Y$. Next day, he gets a little worried and decides to tighten up on the tolerance by modifying it to $T=\frac{X+Y}{N}$. However, he develops new fears, finally makes up his mind that it should be $T=\sqrt{\frac{X+Y}{N}}$.

There are no completely perfect parts, someone said at the Inspection Panel. The problem is to learn what variances to expect and how to live with them.

Bouquets to the technical session secretaries who reported the discussion. They were: **S. P. Mitchell,** Allis-Chalmers; **G. J. Storatz,** International Harvester; **S. C. Heth,** J. I. Case; **E. S. Dahl,** Massey-Harris; **R. A. Holmberg,** International Harvester; and **L. E. Tilbury,** J. I. Case.

Well-paced and smoothly operated technical sessions were a tribute to the session chairmen who were: **T. A. Haller,** Allis-Chalmers; **W. W. Henning,** International Harvester; **Karl Butler,** Avco Manufacturing; **L. C. Evans,** Massey-Harris; **W. R. Dalenberg,** International Harvester; and **L. H. Hodges,** J. I. Case.

Commenting on the SAE's 50th anniversary next year, dinner toastmaster **C. G. A. Rosen** remarked: "The resources we now have in the Society give us a springboard for bridging the future with an even more illustrious 50 years."

As far as **J. K. Jensen** was concerned, the last day of the Meeting was a double header. He was co-author of a paper farm tractor tire testing in the morning session. In the afternoon session, he pinch hit for Max Haack of Germany by reading Haack's paper on tractor seat suspension.

"One of the reasons for America's industrial greatness," said **John C. Warner,** General Manager and Secretary of SAE, in his welcome to Production Forum panel leaders, "is the willingness of American industry to exchange freely technical information." In Europe companies tend to keep things close to the chest. Engineers are even afraid to be seen talking to personnel of rival companies, he went on. In this country, production forums such as this have enabled companies to keep up with technological changes. There is little petty jealousy. And this attitude has benefited the individual men, and contributed to the growth of the companies, the industries and the country.

Art Rosen, while thanking the members for his nomination as SAE President in 1955 said, "Many a man of Presidential timber turns out to be a splinter. This is usually not found out until the party is seated in power."

Official indeed was the welcome Milwaukee gave the SAE National Tractor Meeting. The illuminated sign shown here was displayed in City Hall and lit up each night during the Meeting.

"Sixty percent of all diesels now being manufactured are going into farm and off-the-road equipment," said Past-President **C. E. Frudden,** at the Tractor Meeting Dinner. He saw an increase of this figure in the future.

Record *Tractor Production*

The Tractor Production Forum in Milwaukee on September 13 was an outstanding success according to SAE members and guests who were present. A record turnout—over 750—attended seven separate informal gatherings to exchange information and experience on vital production problems. Each group was sparked by a panel of experts who answered questions on specific as well as general subjects.

Here are some of the points made in the various groups:

Taking The Guess Work Out Of Planning

Usually the most efficient production plan schedules for capacity production. Capacity will vary with different companies and industries. One company gauges top capacity on the basis of two 8-hour shifts.

A production schedule must be flexible. One plant gives a department foreman more than one part to manufacture. Then, in case of machine breakdown, material shortage, or labor trouble, he can switch his department to another operation.

Getting The Most Out of Gear Cutting and Heat Treating Techniques

The ideal case hardness for gears is between 30 and 35 Rockwell. Readings in the forties are too high and below 25 too low. In the case of a seven pitch steel gear it was found that a 28 to 32 Rockwell C hardness was best for that particular tooth. It was subjected to 1680-1700 degrees F (carbonized) and cooled by direct quench.

To reduce gear noise, the density of the forging, the coefficient of sliding friction, the tooth design, the amount of helix, and the crowning must be considered. Modifying the distribution of the load (by crown shaving) will reduce gear noise.

Welding—What's New?

Resistance welding is being used in ever broadening fields. Steels of up to 15 points carbon can be spot welded with little trouble. And steels of up to 50 points can be flash welded without problems.

Arc welding is also expanding in use. The submerged-arc method is used for extremely heavy plate down to 0.06 in. thickness. The inert gas, shielded, tungsten arc method is used for lighter gages—5/32 down to 0.10 in. The inert gas, consumable electrode, shielded method is used for thinner jobs, 2 in. down to 0.060 in. Which of the three methods to use depends upon material to be welded and cost.

Keeping Control Of Indirect Manufacturing Costs

Determining indirect costs does more than show where money has been spent. It also brings out weaknesses in operation and shows management where it must increase operating efficiency.

Cost reports must be both timely and accurate if they are to be an efficient tool of management. For example, the

Forum Leaders and Their Leader

Forum Chairman Conrad briefed his panel leaders just before the panels started. Leaders in the photo at left are (left to right): G. F. Meyer, Welding Panel; L. W. Perkins, Production Planning Panel; General Chairman Conrad (seated); F. S. Burnside, Metal Cutting Panel; and C. E. Verkler, Industrial Engineering Panel. Leaders in the photo at right are (left to right): Dr. R. Moberly, Indirect Manufacturing Costs Panel; General Chairman Conrad; B. W. Keese, Gear Cutting and Heat Treating Panel; and E. L. Fay, Inspection Panel

Forum
Answers Specific Questions

time to realize how much indirect labor costs is at the time it is happening.

Assigning responsibility at a low level of control—such as the shop foreman—increases efficiency. If the foreman attaches colored tags to the worker's time cards, he can tell at a glance how many men are doing productive work (red tags) and how many are non-productive (green tags). Soon he will learn to plan the next day's work so that a productive worker is not wasted sweeping, cleaning, or repairing.

Where And How Industrial Engineering Fits Into The Manufacuring Organization

The object of industrial engineering in the direct manufacturing divisions is to keep employees, machinery, equipment, and materials most profitably employed. Thus plant facilities can be used fully and employment stabilized. This implies having perfect teamwork between all departments of the company.

Good industrial engineering starts at the drawing board and continues until the product is produced. One company assigns a project engineer who has complete authority over the project, including plant layout, tooling, routing, and processing.

An important function of industrial engineering is labor relations and the establishing of wage systems.

Metal Cutting—New Angles on an Old Art

Cutting metals fast, accurately and economically continually calls for specific advances in technique. One innovation is the use of ultrasonics. Ultrasonics can machine materials which are too hard to be machined by conventional methods. The automotive industry uses ultrasonics to remove chips. The pieces are passed through a solvent and the chips vibrated out.

More and more carbide tools are being used on lathes and screw machines because they reduce cost.

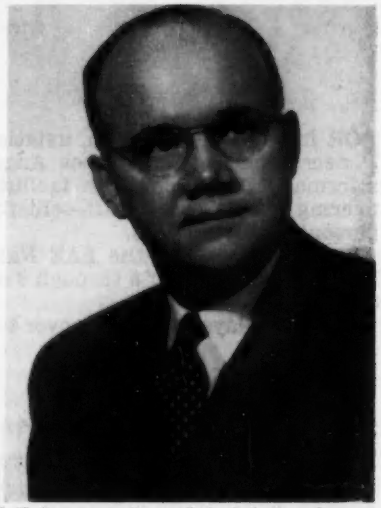
Vapor blasting and steam treating increases tool life. Vapor blasting is much more reliable than hand honing and it exposes surface checks.

Bringing Inspection Into the Production Team

There is more to inspection than merely rejecting bad pieces. The inspection unit should use Statistical Quality Controls to collect, tabulate, analyze and interpret data for the other departments, so that quality can be improved and maintained while costs are lowered.

Ideally, quality should be designed into a product. Often designers will request specifications and tolerances that production says are impossible. By studying the process capabilities, the inspection unit can find out just what the men and machines are capable of doing. Then it may be necessary to revise the standard or develop tooling and workers capable of meeting the standard.

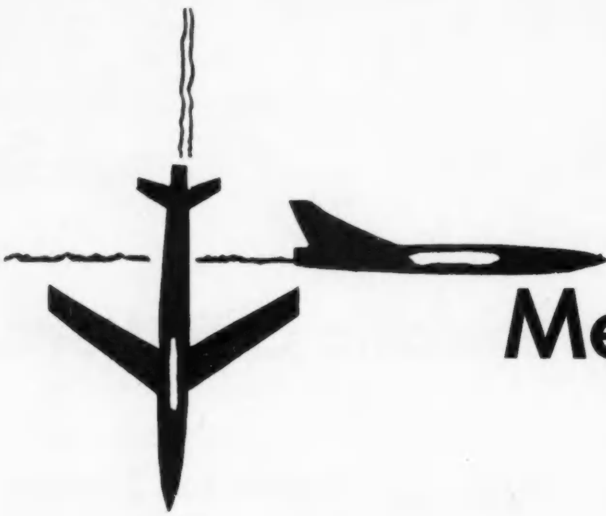
Production Sponsor



J. T Brown, president of the J. I. Case Co. was sponsor of the Tractor Production Forum

Turning Over the Reins

L. W. Conrad (left), general chairman of the 1954 Tractor Production Forum, congratulates A. A. Herzberg on accepting the chairmanship for the '55 Production Forum



Meeting Delves

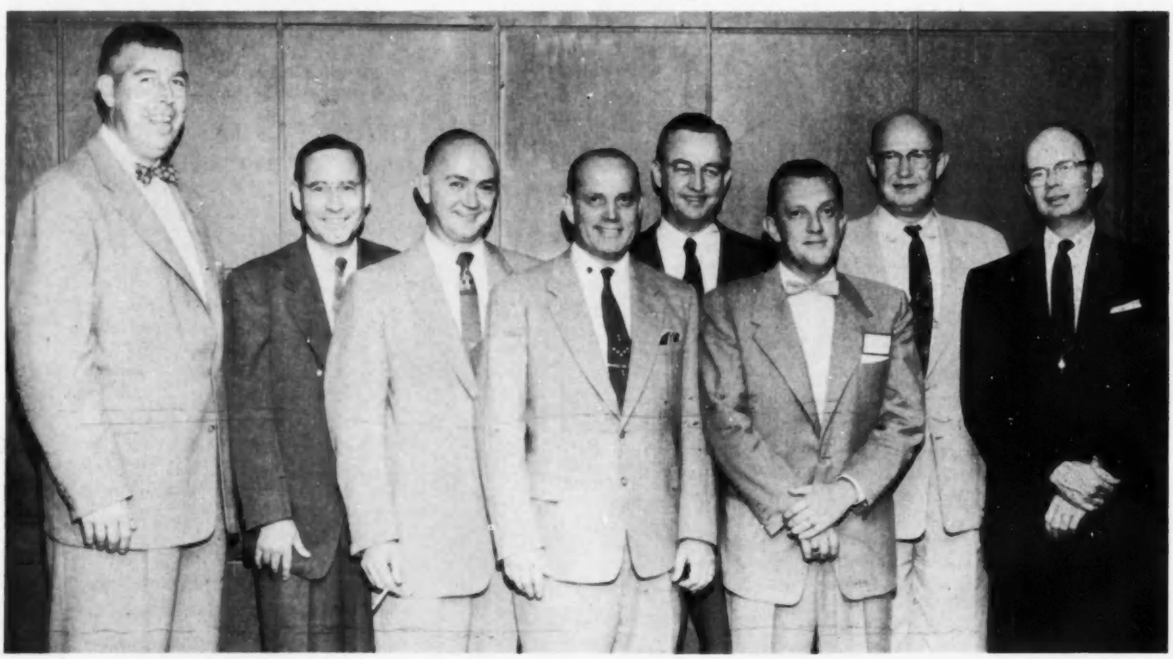
FOR five days last month, aviation-industry engineers congregated in Los Angeles to exchange information on production facilities for and engineering design of aircraft—chiefly tomorrow's supersonic attack planes.

The occasion was the SAE National Aeronautic Meeting held October 5 through 9 at the Los Angeles Statler.

First two days were given over to an Aircraft Production Forum considering "Planned Flexibility for Defense. Some 1600 production specialists flocked to 10 panel discussions organized under the leadership of General Chairman H. W. Thue of Douglas and backed by Sponsor W. C. Collins of Northrop.

Three days of technical sessions followed, boosting total attendance to 2800. Interspersed among the 32 technical papers were an address on "Atomic Energy" by Representative Carl Hinshaw and a

Some of the Committeemen Who Planned the Program



Credit for crowd-drawing program of technical sessions should go to Meeting General Chairman J. H. Famme and members of his hard-working program committee, seven of whom are shown here: H. W. Holzapfel (left), L. D. Bonham, F. O. Hosterman, Famme, F. W. Fink, F. E. McCreery, Jr., W. C. Heath, and W. T. Immenschuh. Committee members missing from the picture are J. B. Cooper, W. T. Dickenson, C. J. Hansen, R. H. Loughran, Edgar Schmued, C. H. Stevenson, and J. B. Wassall

into Problems

of Mach 1.5+ Attack Planes

"Progress Report on Canadian Aviation" by The Right Honorable C. D. Howe, who received the Guggenheim Medal. Final event of the Meeting was a Saturday evening dinner-dance in the Statler's Pacific Ballroom.

The 13 technical sessions made it clear that designers have had enough experience with Mach 1.5+ planes to know what problems are involved in their airframes, equipment, and powerplants.

Airframe men disclosed that you can't design structures of high-performance fighters and interceptors for static loads alone, as has been the practice with subsonic craft. Thin, lightly loaded wings suffer fatigue stressing to such an extent that structures men must consider these lesser-but-repeated loads as well.

Thin wings tend to develop flutter, too—a phenomenon which, meeting participants were glad to hear, has a useful electrical analogy. This makes it possible to study flutter characteristics of proposed designs on an electric analog.

Minimizing weight is still one of the aircraft designer's chief worries, of course. Airframe men speculated hopefully about new light-weight all-metal sandwich material and husky new plastics. At the same time, they cautioned each other not to add weighty equipment unless it outbalances the penalties it incurs in performance and producibility.

As one designer explained, each time you add equipment weight to a typical fighter, you have to increase the containing airframe. Then if you can't accept a loss in performance, range, or payload, you must resort to a more powerful, heavier engine and the added fuel it uses. It averages out that for 1 lb of added equipment, gross weight goes up 10 lb.

Since aircraft tend to cost around $50 per lb gross weight, adding 1 lb of equipment costs $500. Besides, it's likely to increase shop workers' learning time, production time, and chances for in-service break-down.

But even with these admonitions, designers indicated they were admitting more and more gadgets to fast new craft. In passing, they complimented makers of electronic and hydraulic equipment for making their newest generation of products smaller and more reliable.

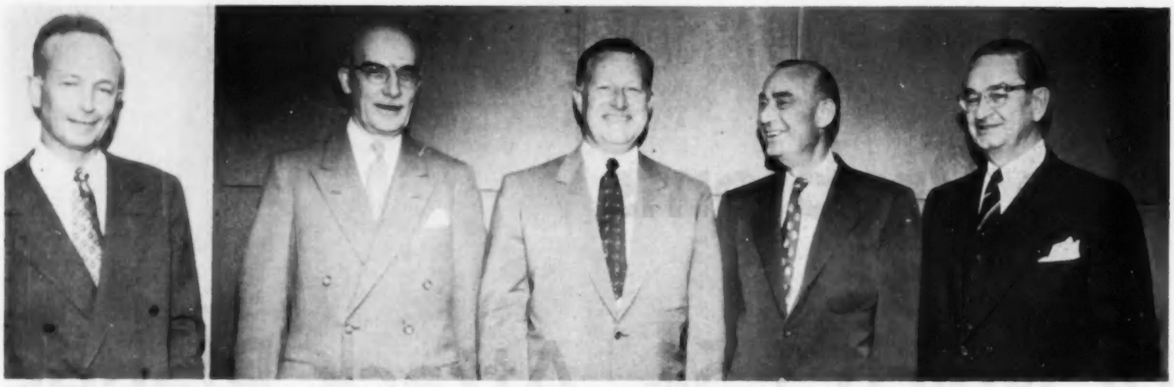
Possible clues to increased reliability of equipment came from a symposium on packaging. It revealed that electronics manufacturers have adopted the philosophy that packaging is part of the product. They are accepting more of the responsibility for seeing that their delicate units travel unharmed by ordinary rough handling or truck vibration. Their studies of transit shocks and vibration, cushioning material characteristics, and equipment fragility are turning the art of packaging into a science.

Not much was said at the Meeting about powerplants for the Mach 1.5+ planes because of security restrictions. But it was evident that one of the headaches plaguing the engine end of the industry is the corrosivity of synthetic lubricants. The synthetics do a fine job of carrying loads and protecting hot bearings, but they tend to eat the paint off any extra-engine surfaces they touch.

Besides, in certain aircraft pressurized by air bled from the powerplant compressor, crew members complain of eye irritation and nausea. Evidently the synthetics decompose at high temperatures. Then noxious decomposition products find their way into the compressor air stream and eventually into the cabin.

All 32 papers presented at the meeting will be treated in more-or-less abridged form in subsequent issues of SAE Journal. On the following pages are highlights of each paper.

President Littlewood with Aviation Industry Leaders



J. L. Atwood, president of North American Aviation; and John Hamilton Parkin of Canada's National Research Council; SAE President William Littlewood; Gen. Joseph T. McNarney, president of Convair, and W. C. Collins, president of Northrop

Highlights from the Papers

Thin Wings

It's possible to determine mathematically the optimum proportions for minimum-weight multispar box beams in pure bending.

The analysis requires the assumption that simultaneous failure of the skin in compression and the web in crushing of a concentric pin-connected multispar constitutes the basis for optimum structure in pure bending.

Test results using formed channels with small bend radii indicate that these assumptions closely approximate the behavior and proportions of the optimum structure for straight thin wings.
. . . **W. J. Conway, Lockheed Aircraft Corp.**, "Factors Affecting the Design of Thin Wings"

Flutter Studies

Douglas investigated flutter characteristics of a swept-wing jet bomber three ways: (1) by "flying" a small-scale model in a wind tunnel, (2) by calculations on a digital computer, and (3) by an analogy worked out on an electric analog.

Chief difficulties in the two analytical methods were predicting wing torsional frequencies and representing the nacelle-pylon charcateristics.

When these difficulties were ironed out, results of the three methods agreed reasonably well with actual flight test data.
. . . **D. G. Dill, M. D. Lamoree, F. W. Melching, and R. H. Stringham, Douglas Aircraft Co., Inc.**, "A Comparison of Experimental and Analytical Flutter Characteristics For a Swept Wing Jet Bomber"

Too Many Fatigue Failures

The incidence of fatigue failures in primary structural members of military aircraft has increased significantly in the last decade. Fatigue failures are no longer merely "sporadic."

Basis of our attack on the fatigue problem is application of engineering effort specifically focused on fatigue at every phase of the life of each model.
. . . **A. J. Kullas, The Glenn L. Martin Co.**, "A Plan of Attack on Aircraft Fatigue"

Fatigue Sources

Analysis of the total fatigue damage during 100 flight hours by a hypothetical all-purpose fighter and a hypothetical long-range interceptor shows that: The largest portion of damage in each case is done by the maneuver loads.

This is partly because the planes were designed for wing loading factors of 5.5g's. Planes designed to higher loadings would show less gust damage. At any load factor, low-altitude missions result in more gust damage than high-altitude missions.
. . . **G. N. Mangurian and P. D. Brooks, Northrop Aircraft, Inc.**, "Effects of Operational Factors on Structural Fatigue in Fighter Type Aircraft"

Lower Landing Speeds, Please

As designers, we must do all we can to reduce landing speeds of supersonic fighters and interceptors.

Too, pilots need to be taught how to land at the lowest speeds their planes permit. To insure making the runway in case of engine failure, the average fighter pilot increases his landing touchdown speed above recommended speed by 5 knots for his wife and 5 knots for each of his children. And most of these pilots seem to have at least five children. Accidents result.
. . . **E. S. Hodder, North American Aviation, Inc.**, "Problems of High Speed Flight"

Too Much Roll

Rolling pull-out maneuvers at subsonic speeds can impose tremendous loads on the wing and on the vertical control surface of supersonic aircraft. Rates of roll as high as 900 deg per sec are possible. On a typical fighter, it takes 310 lb in wing skins and bulk-

heads to carry 900-deg-per-sec torque loads in excess of those produced when rate of roll is arbitrarily limited to 300 deg per sec. Loadings on external stores and integral fuel tanks are virtually impossible to accommodate.

The weight penalty makes it imperative to restrict rate of roll. Further study shows that it can be done by limiting maximum aileron deflection in accordance with Mach number.

. . . **F. C. Allen, Douglas Aircraft Co., Inc.,** "Unsymmetrical Flight Load Problems in Supersonic Aircraft"

Flight Load Measurements

Every Lockheed prototype airplane for the past 12 years has had a flight load measurement program conducted on it. The program is, in general, carried out during the normal flight test program, although recently some airplanes have been assigned exclusively to structural load measurement for a period.

Wing bending moment measurements occupy the largest portion of the program.

Such testing insures safety, gives added confidence to the flight-test crew, and makes it possible to take advantage of all the strength a design has.

. . . **W. L. Howland and C. J. Buzzetti, Lockheed Aircraft Corp.,** "Flight Load Measurements and Analysis"

Boundary Layer Control

Good control of the boundary layer over a wing flap can be achieved by ejecting high-energy air from a narrow slot above and ahead of a single-slotted flap. This prevents turbulent-flow separation on the upper surface of the flap and re-establishes a stagnation point at the flap trailing edge.

BLC makes it possible to take off, climb, and land at speeds about 25% below speeds otherwise required. Landing and take-off distances decrease 40 to 50%. No stability or control problems are inherent in application of properly designed BLC.

. . . **Kenneth Razak, University of Wichita,** "Boundary Layer Control by Blowing—A Method of Increasing Flap Effectiveness"

Contouring Honeycomb

There are several ways to contour honeycomb core for sandwich structure. One way is to freeze the expanded core in ice and mill at below-freezing tem-

Around the Meeting . . .

SAE will publish a set of reports on all 10 Aircraft Production Forum Panels. Order it as SP-309 from the SAE Special Publications Department, 29 West 39 Street, New York 18, N. Y. Price is $2 to SAE members, $4 to nonmembers.

SP-309 will go to press as soon as reports are received from all 10 panel secretaries.

SAE Journal will, in subsequent issues, carry articles based on each of the reports.

Said Representative **Carl Hinshaw** of California speaking on "The Engineering Challenge of Peacetime Atomic Development":

"It is painful to an engineer to see an engine produced which will not get the maximum energy value out of the fuel it consumes. Yet squeezing out every last kilowatt of heat energy from nuclear fuel rods may well not be the most "efficient" way to run an atomic powerplant. Recovery of all the nuclear fuel from the ashes of an atomic powerplant may prove to be inefficient, unwarranted, and downright dangerous."

"The optimum size of atomic powerplants may prove to be between 1,000,000 and 10,000,000 kw per hr output of electricity. This is more than almost any single electric system in the United States uses. Thus one plant will serve a larger area, and radical revisions in our approaches to electric transmission may be in order."

"But with the advent of atomic energy, our large power-consuming industries are not dependent on electrical power. Now these industries can be located at the most efficient point in the production pattern without regard to conventional power sources."

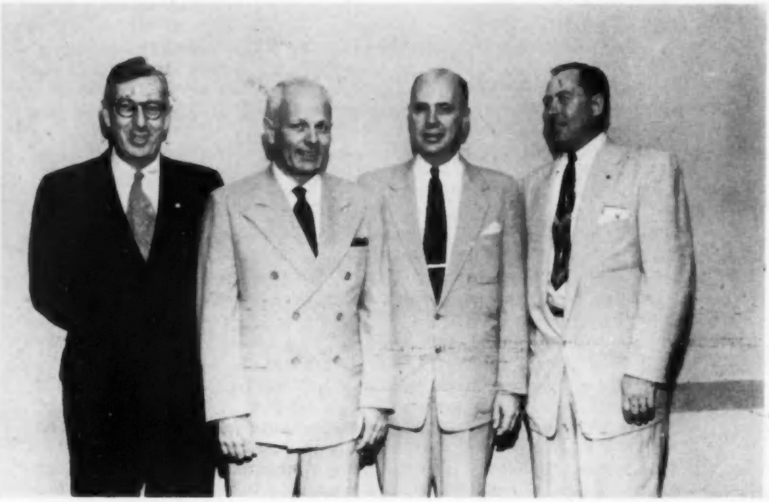
Canada's aircraft powerplant factories are turning out turbojets for $10 per pound thrust, a considerably lower figure than U. S. jets cost, reported **C. D. Howe**, Canada's Minister of Defense Production in his "Progress Report on Canadian Aviation."

Committee S-8, Aircraft Shock and Vibration Isolation cosponsored the Thursday morning-and-afternoon symposium on "Compatible Design of Equipment and Its Packaging." Committee S-8 is a subcommittee of the SAE Aeronautics Committee's Special Aircraft Projects Division.

Serving at the 12 sessions to introduce speakers and record discussion were:

Chairmen	Secretaries
Herman Pusin, Glenn L. Martin	**G. G. Green**, Consolidated Vultee
Jack Craig, Jr., Pratt and Whitney Aircraft	**H. J. Graninger**, Wright Aeronautical
J. T. Muller, Consulting Engineer	**F. Mintz**, Armour Research Foundation
W. L. Hardy, Foster D. Snell Co.	**F. Mintz**, Armour Research Foundation
Harrison Holzapfel, Western Air Lines	**P. R. Strohm**, Trans World Airlines
P. L. Ward, Solar Aircraft	**F. J. Fillippi**, Solar Aircraft
F. W. Fink, Convair	**T. N. Baker**, Hammond Manufacturing
R. G. Christensen, Boeing	**J. S. Fitzpatrick**, Boeing
H. G. Erickson, Temco Aircraft	**E. D. Rohn**, Convair
H. H. Rhoads, Hydro-Aire	**John Dannan**, Hydro-Aire
Brig.-Gen. B. S. Kelsey, USAF	**R. L. Bayless**, Consolidated Vultee
A. T. Burton, North American Aviation	**P. H. Lyman**, North American Aviation
C. J. Hansen, North American Aviation	**G. H. Arvin**, North American Aviation

East meets West



R. E. Johnson (left) of Wright Aeronautical in New Jersey, D. F. Derbyshire of Rohr in California, G. W. Newton of ARO in Tennessee, and M. E. Russell, Sr. of Ethyl's Los Angeles office get together. Johnson and Newton are meetings vice-chairman and vice-president, respectively, of the Aircraft Powerplant Activity. Derbyshire is chairman of SAE San Diego Section, and Russell is chairman of SAE Southern California Section

peratures. A second way is to set the core in plaster of paris and let the plaster harden before attempting contouring.

Another method that may prove practical is electrical disintegration.
. . . **J. V. Long and G. D. Cremer, Solar Aircraft Co.**, "High Temperature All-Metal Sandwich Structures"

Cooling Feverish Skins

One way to cool the skin of a missile during its final plunge is to force water through a porous outer skin and let it evaporate.

Another method is to evaporate and then superheat the vapor in the interior of the structure.
. . . **S. L. Shaw, Douglas Aircraft Co., Inc.**, "Selection of Aircraft Construction Materials"

Growth Factor

Here's what we mean by growth factor: Given a set of reasonable design requirements and specifications, a particular aircraft can be conceived which exactly meets these requirements. The aircraft will have a certain engine, a certain gross weight, and a certain geometric, structural, and aerodynamic arrangement. If, for any reason, there must be an increase in fixed weight, additional gross weight must be added to the aircraft so that it will meet the new requirements.

The ratio of the total gross weight change to the fixed weight added is the growth factor.
. . . **W. F. Ballhaus, Northrop Aircraft, Inc.**, "Clear Design Thinking Using the Aircraft Growth Factor"

Airborne 5.5 Cm Radar

Our evaluation of the RCA 5.5-cm-wavelength airborne weather radar shows that it enables the pilot to:

- Spot a storm area 75 miles away and detour it with very little increase in flight time.
- Choose a corridor of the least turbulence if he must penetrate the storm area.
- Scan the area around an airport before take-off or landing to determine the best flight path.
- Determine his position relative to high terrain or other easily distinguishable ground features.

. . . **E. A. Post, United Air Lines**, "The Application of Airborne Radar to Airline Operations"

3.2 Cm Radar

Braniff has been evaluating AN/APS-42 radar equipment for the Navy Bureau of Aeronautics on Latin American routes. Pilots find this 3.2-cm-wavelength radar a big help in avoiding thunderstorms and in identifying their location. Islands and other landmarks show up clearly.

No particular difficulties have arisen in installing the radar or in maintaining it.
. . . **H. O. Harrison, Braniff International Airways**, "A Summary of Braniff International Airways' AN/APS-42 Airborne Radar Evaluation Project"

Unitize the Electronics

I believe that in the event of any great increase in military airborne equipment requirements, the solution most feasible economically will be unitized electronic equipment.

Unitizing allows speedy inspection and replacement and deferred repair.
. . . **R. J. Cary, Ryan Aeronautical Co.**, "Aircraft Environment and Airborne Electronic Equipment Packaging"

Pneumatic Power

Pneumatic accessory drives—in which air bled from a propulsion engine spins a turbine—are lighter and more flexible than other means of accessory power transmission But they penalize performance.

A typical analysis of engine bleed air performance penalty at high altitude indicates that: One pound of thrust costs 5 lb of weight or 4 ft of altitude. One per cent of bleed costs 2.7% thrust.
. . . **G. A. Lemke, Convair**, "Operational Experience—Pneumatic Components of Cabin Pressurization and Accessory Drive Systems"

Plastic Structures

Plastics are no longer merely substitutes for other materials. Plastic tur-

bine blades are spinning in jet engines. Plastic rocket cases and nozzles are dong a better job than steel. Plastic wings are soaring on missiles—and proving superior to their magnesium counterparts.

Biggest improvements in quality can come from bettering fabrication techniques for the plastics we now have.
. . . **D. M. Hatch, Jr. and W. Crofut, Hughes Aircraft Co.,** "Development of High Quality Plastics Components"

Air-Age Packaging

The Air Force spends about $750,000,000 a year on packaging. About 8½¢ of the procurement dollar goes for packaging.

Goal of packaging should be to protect the contents—at minimum expense in weight and bulk.
. . . **S. M. Birnbaum, Wright Air Development Center,** "Air Force Packaging Problems"

Fragility Rating

We conceive of a two-part fragility rating: (1) the number of g's the item can tolerate without damage, and (2) the natural frequencies of any component of the item occurring below 75 cps.

The g rating might be devised on the basis of a shock applied 10 times in the mounting position, 10 additional times in the two mutually perpendicular planes, plus 10 more times in directions to be chosen by the design engineer.
. . . **W. H. Skidmore, Weston Electrical Instrument Corp.,** "Fragility Rating for Aircraft Equipment"

Cushion Rating

It appears possible to judge materials by a simple dynamic load test. Driving a body into a resilient material and recording both the displacement and force and comparing them with a calculated pulse may lead us to the development of desirable characteristics in cushioning materials that we have been overlooking.
. . . **J. T. Muller, Sperry Gyroscope Co.,** "Optimum Properties of a Packaging Material"

Picturing Packaging

High-speed motion picture films can provide accurate measurements of displacements, velocities, and accelerations—as well as a view of what actually happens to packaged equipment during shock and vibration.

In two commercially available cameras used for packaging studies, a rotating prism turns in sync with the film and causes the image to follow the moving film during the exposure interval of each frame. This allows the film to go through the camera continuously instead of in jerks. With high-speed electric motors propelling the film, an entire 100-ft roll can be exposed in 1–2 sec.
. . . **R. D. Hawkins, Sperry Gyroscope Co.,** "High-Speed Motion Photography as a Tool in Shock and Vibration"

Picking the Powerplant

Up to the present time, engines with the best fuel economy, even though somewhat heavier than their less economical competitors, have turned out to be better for high-performance military aircraft, even for short-range types.

Very high flight speeds require afterburning engines. For almost all other applications the non-afterburning engine is superior.

Experience with design of fast, lightweight military aircraft tends to favor the minimum number of engines, except where safety considerations overshadow all others.
. . . **E. H. Heinemann, Douglas Aircraft Co., Inc.,** "Design of Light-Weight, High-Performance Military Aircraft"

Bouquet for Turboprops

Convair believes that the turboprop deserves a place of its own in the aviation industry and is not merely a stepping stone to the turbojet. All the turboprop needs to come into its own is a firm, aggressively backed development program.
. . . **W. W. Withee, Consolidated Vultee Aircraft Corp.,** "Turbo Prop Installation in Large Water Based Aircraft"

Turboprop Propellers

Propellers of conventional diameters (13 to 15 ft) having eight or more blades arranged in two rows can efficiently absorb very large powers at high speeds—provided the section thickness ratios are maintained at low values along the blade radius.

For example, a conventional-size propeller of eight blades of conven-

Webb, Hinshaw, and Warner

Capt. L. D. Webb (left), Representative Carl Hinshaw of California, and SAE Secretary and General Manager John A. C. Warner. Capt. Webb is vice president and Western Regional manager of the Aircraft Industries Association of America, Inc., which—together with the Air Transport Association of America—cooperated on the Meeting. Rep. Hinshaw, who is the ranking majority member of the Joint Committee on Atomic Energy of the U. S. Congress, is an engineer and an SAE member

tional widths will absorb greater than 20,000 hp at forward Mach numbers exceeding 1.5 with reasonably good efficiency at altitude, provided low section thicknesses are used.
... **F. B. Stulen, Curtiss-Wright Corp. Propeller Division**, "The Structural Design of High-Speed Propellers."

Air Starter

Solar has developed air compressor versions of its Jupiter gas turbine powerplants originally developed for shipboard use. The compressors serve as ground starters for aircraft propulsion turbines.

A complete starter cart weighs 2500 lb. It is 120 in. long, 71 in. high, and 58 in. wide. Fuel consumption ranges from 30 to 60 gal per hr, depending on load and ambient conditions.
... **P. G. Carlson, Solar Aircraft Co.**, "A 500 HP Gas Turbine Engine to Supply Compressed Air"

Synthetic Lubes

Synthetic lubricants decompose at high temperatures into noxious and poisonous compounds. If these compounds are present in compressor air extracted to pressurize the cabin, we're in trouble.

But with the three latest current synthetic lubricants in various Convair aircraft, we've found that contamination is not as bad as we feared it might be. Where it does exist, unpleasant odors and eye-and-nose irritants are the chief troubles.
... **C. S. Brandt, Convair**, "Experience with Synthetic Lubricants in Aircraft Power Plants"

Jet Fuels

Below 25,000 ft, combustion efficiencies of turbine engine fuels are high and are unaffected by fuel type or by power output level. There's little difference in efficiency between such widely differing fuels as aviation gasoline and diesel fuel.

Above 25,000 ft, combustion efficiency decreases as altitude increases. The change is slight at rated power output. But at reduced output, the heavier fuels show markedly reduced combustion efficiency.
... **C. M. Kuhbach, W. F. Ritcheske, and K. H. Strauss, The Texas Co.**, "Fuel Properties and Jet Engine Combustor Performance"

Preventing Crash Fires

Government and industry are developing rapid cooling of hot engine parts to prevent crash fires. The idea is that a crash will initiate a water spray directed at hot engine and exhaust surfaces.

The resulting steam will keep fuel out of contact with hot surfaces until they've cooled.

Contracts have been awarded for development of such systems for both turbine and piston engines.
... **R. L. Nordli, Wright Air Development Center**, "The Installation Barrier"

Combatting Fuel Ice

Forcing dry air through fuel removes much of the dissolved water. JP-4 jet fuel can be dried at a reasonable rate by flowing a large volume of air over the surface of agitated fuel—or even faster by bubbling a relatively small volume of air through the fuel. JP-5 dries more slowly.

Only 1% of the JP-4 evaporates. Even less JP-5 is lost. JP-4's volatility drops 1 to 1.5 psi RVP, but JP-5's change is negligible.
... **J. F. Madden and E. A. Droegemueller, Pratt & Whitney Aircraft**, "Tank Ventilation to Combat Fuel System Icing"

Afterburners Are Noisy

In the reliability testing of afterburner temperature controls, it has been found that the most destructive vibration results from engine noise. A noise meter that read 110 db directly in front of an auto horn went off scale at 160 db in the engine test cell during afterburner operation. The 160+ db reading indicated that acoustical power of the engine noise was more than 100,000 times that of the horn.

Fortunately, noise level in the nacelle is considerably lower than that in a test cell.
... **G. R. Desi and C. F. Wood, Westinghouse Electric Corp.**, "Reliability of Temperature Controls"

Americanizing the Marbore

In Americanizing the French Marbore into the J-69, Continental first translated drawing notes, standards books, and process sheets into English, changing metric dimensions into English equivalents. In most cases, there were no exactly equivalent threaded fasteners, gears, or sheet metal gages available here. So suitable American sizes had to be figured out.

American nickel-rich alloys were substituted for French cobalt-rich alloys for high-temperature parts.

Also, the design was modified for American assembly-line production and for Air Force requirements.

But the fundamental aero-thermodynamic design remains the same. And the American version gives the same excellent performance.
... **J. C. Squiers, Continental Aviation and Engineering Corporation**, "Small Turbojet for Trainer Aircraft"

Army Depends on Aircraft

Today the Army is primarily dependent upon aircraft to achieve the mobility which it requires.

Some people feel that the Army seeks an Air Force of its own. This, I feel, is due to a confusion between missions and equipment. Just as the Navy needs cars and the air Force needs crash boats, the Army needs aircraft.

The areas in which satellite incidents—like Korea—could occur in the future are primarily in the backward areas in which the helicopter offers the only way of effectively conducting and supporting ground operations.
... **Col. W. B. Bunker, U. S. Army Transportation School**, "Mobility for Ground Troops"

Future Military Transports

Airplanes powered by turboprop engines provide lower direct operating cost per ton-mile than airplanes powered by compound-reciprocating or turbojet engines. This was true for any combination of design speed, payload, and range considered in a study of possible transport airplanes of the 1960's, made by the Rand Corporation for the Air Force.

The study showed also that selection of a preferred airplane should be based on the cost to perform the total logistics job by a fleet of the airplanes, rather than on the ability of one airplane to fulfill some single payload-range requirement.
... **T. V. Jones** and **Aircraft Design Section of The Rand Corp.**, "Capabilities and Operating Costs of Possible Future Transport Airplanes"

Forum Seeks

More Production Flexibility

The 10-panel Aircraft Production Forum held Tuesday and Wednesday, October 5 and 6, preceding the Meeting's technical sessions drew more participants than ever.

Registration totaled 1569. Panels on In-Plant Communication, Tabulating in Industry, Electronics, and Education in Industry, all new for 1954, were as popular as the six repeated subjects.

Throughout all 10 panels, the emphasis was on bettering human relations. There's no substitute for close teamwork between production and design engineers, panellists found themselves concluding in case after case. So insistent were they on that idea that it became the theme for next year's Aircraft Production Forum.

SAE President announced at the conclusion of the Wednesday afternoon discussions that for the 1955 Forum Welwood E. Beall would be sponsor and B. F. Raynes general chairman. Beall is vice president of engineering and sales for Boeing. Raynes is vice president, manufacturing, of Rohr Aircraft.

Photographs of the members of this year's 10 panels appear on the next two pages.

"Well Worth the Effort"

"It was well worth the effort," agree H. W. Thue and W. C. Collins as they hear the news that 1569 people registered for the Aircraft Production Forum. As Forum chairman and sponsor, respectively, they carried top responsibility for the event from the time first plans were laid a year ago

Presenting the Experts Who Served on

Education in Industry . . . (left to right) E. F. Sproule, M. S. Lachman, J. J. Schwarz, J. A. Peart, E. A. Puffer, J. F. Honesco

Forming . . . (left to right) J. M. Ohlson, K. A. Wilhelm, J. A. Runner, H. C. Emerson, A. Crom, W. T. Kluge

Control of Manufacturing Costs . . . (left to right) J. F. Knapp, J. W. Pocock, M. A. O'Connor, M. Harper, A. F. Kitchin, H. E. Herdrich, J. Isaac

Machining . . . (left to right) F. M. Rayburn, C. M. Rhoades, Jr., E. F. Mellinger, R. B. Parkhurst, W. E. Brainard, J. C. Hebert, L. Fersing, H. E. Fortney

Effective In-Plant Communications . . . (left to right) J. L. Crawford, G. D. Bradley, E. H. Moore, L. Stockford, H. Thaw, K. Arnold

the 10 Aircraft Production Panels

Electronics . . . (left to right) L. L. Galloway, J. T. Wells, H. L. Ellsworth, F. B. Kemper, H. J. Swartz, W. C. Urlovic, L. N. Welch, W. B. Plasse, C. J. Breitwieser

Change Control . . . (left to right) R. L. Lewis, P. Rafter, G. Smith, J. R. Allen, D. C. MacArthur, R. B. Carlson, N. F. Johns

Tabulating in Industry . . . (left to right) K. Porteous, W. P. Bamrick, C. H. Buse, W. E. Wheeler, F. C. Carlin, R. G. Canning, F. J. Knight

Economics of Tooling . . . (left to right) W. E. Green, Jr., A. S. Hartwig, G. W. Periman, G. A. Evans, N. H. Lou, W. Krug, R. L. Grunewald, D. Gilmore

Quality Control . . . (left to right) J. W. Young, J. Mannion, I. Dagan, G. A. Covington, H. W. Hill, D. R. Archibold

Aircraft

Draws Visiting Engineers to

Aeroproducts—Allison Division,
General Motors Corp.

Aeroquip Corp.

AiResearch Mfg. Co.

American Steel and Wire Division,
United States Steel Corp.

Bendix Products Division,
Bendix Aviation Corp.

The Cleveland Pneumatic Tool Co.

Fairchild Engine & Airplane Corp.

Foote Bros. Gear & Machine Corp.

General Controls Co.

Hamilton Standard Division,
United Aircraft Corp.

Hi-Shear Rivet Tool Co.

Keystone Engineering Co.

Lear, Inc.

Lord Mfg. Co.

Magnaflux Corp.

Marrotta Valve Co.

Meletron Corp.

Monogram Mfg. Co.

New York Air Brake Co.

Display

Exhibits of 38 Companies

O & M Machine Co.

Pacific Airmotive Corp.

Pacific Scientific Division,
Bendix Aviation Corp.

Red Bank Division,
Bendix Aviation Corp.

Resistoflex Corp.

Rosan, Inc.

Rubber Teck, Inc.

Ryan Aeronautical Co.

Scintilla Magneto Division,
Bendix Aviation Corp.

Sinclair Refining Co.

A. O. Smith Corp.

Solar Aircraft Co.

Stratos Division,
Fairchild Engine & Airplane Corp.

Sun Electric Corp.

Titeflex, Inc.

Vickers, Inc.

Western Gear Works.

Franklin C. Wolfe Co., Inc.

Wyman-Gordon Co.

Howe Receives Guggenheim Medal

The Right Honorable Clarence Decatur Howe, recipient of the Guggenheim award looks over the scroll and medal with J. Carlton Ward, who made the presentation at the Friday evening session

THE Right Honorable Clarence Decatur Howe, Canadian engineer and statesman, received the Daniel Guggenheim Medal at the Friday evening, October 8, session. J. Carlton Ward, Jr., chairman of the Daniel Guggenheim Medal Board of Award made the presentation on behalf of the American Society of Mechanical Engineers, the Institute of the Aeronautical Sciences, and the SAE, which jointly sponsor the award.

Howe was honored for "initiating and organizing commercial air routes and services, promoting aeronautical research, development and production of aircraft and engines, and advancing the art of aeronautics." He is a civil engineer who as a Canadian cabinet minister ever since 1935 has been responsible for most of his government's developments in aviation.

In a "Progress Report on Canadian Aviation" Howe said:

"The basis of Canadian air transport organization was that Trans-Canada Air Lines would have an exclusive franchise to carry east and west traffic across Canada, on the principle that our small population would not warrant competition on this route. Service to the northland was reserved for private operators.

Air Transport Without Subsidy

"It is the policy of the Government that no competition should be allowed between regular services—the object being to achieve economic stability without Government subsidy, and to allow traffic to develop at least to a point where it would be sufficient to sustain competition. As a result Canadian aviation has developed to its present high status, in relation to the population of Canada, without subsidy.

"Trans-Canada Air Lines, while owned by the Government, conducts its affairs as an ordinary private corporation. Its capital of 25 million dollars has not been increased for some years, and it usually succeeds in turning in a small operating profit, after paying all taxes assessed against a private corporation. . . ."

"For several years some 15% of the Canadian defence budget has been spent on equipment for our NATO allies. Canada has supplied to the United Kingdom 370 F-86 aircraft, and, more recently, approval has been given to the supply of 164 additional aircraft of the F-86 type to other allies. We on our part have never accepted military aid from the United States, but have purchased our requirements from your country at going prices.

"The sharing of tasks arranged through NATO is such that our contributions to the common effort will be in the fields of training, anti-submarine patrol, and fighter forces. Therefore, our industrial effort is concentrated on aircraft for these duties. Support operations are carried out using aircraft purchased from other countries, or with aircraft developed from existing types available to us.

"In our specialized fields, we do not seek to develop our own equipment if we can obtain a satisfactory type elsewhere. If such a type is available, we normally obtain a license to manufacture in Canada. If our military advisers decide that Canadian problems require a solution different from that needed elsewhere, then we undertake the necessary development."

Driver Education
the Key
to Safe Operation
of Motor Vehicles

by Amos E. Neyhart

Administrative Head, Institute of Public Safety
The Pennsylvania State University, State College, Pa.

Consultant on Driver Education, American Automobile Association

Secretary, National Advisory Committee for Motor Fleet Supervisor Training

Delivered by Amos E. Neyhart at the National Safety Congress, October 18, 1954.

The Eighth SAE Beecroft Memorial Lecture

LITTLE did I even dream, in the early 30's, when I was working to perfect a system to be used in our high schools to train boys and girls to drive an automobile, that I would be honored in 1954 by the privilege of delivering this eighth David Beecroft Memorial Lecture.

I humbly accept this high honor on behalf of the hundreds of college professors and the thousands of high school teachers and motor vehicle fleet supervisors who have put into practice the techniques learned while enrolled in hundreds of special instructor preparation courses during the past 18 years. They are the ones who have proved beyond doubt the value and practicability of that early endeavor. Driver Education is now widely recognized as *the key to the safe and efficient operation of motor vehicles*.

I also owe a personal debt of gratitude for any achievements which led to the granting of this award to the hard work and devoted service of the staff of the Institute of Public Safety of The Pennsylvania State University, to the Traffic Engineering and Safety Department of the American Automobile Association, and to the National Advisory Committee for Motor Fleet Supervisor Training.

Indeed, I feel highly honored to be added to the

group of distinguished men to whom this award has been given previously.

* * * * * *

Since the high school Driver Education program is by far the most fundamental and far-reaching of the various types of Driver Education that have developed since the early 30's, I shall discuss it in detail first. Later, in this paper, I shall comment on these other programs and their potentials.

* * * * * *

I. Why Driver Education?

Let's take a look at the opening statement on page 1 of SAFETY EDUCATION, the Eighteenth Yearbook of the American Association of School Administrators, which reads as follows:

> "It is to the school particularly that we must look for the development of the knowledge, the attitudes, the habits and the skills that are necessary if we are to live with reasonable safety in the modern world."

This statement does not mean that the schools will solve all safety problems, but much lies in the words spoken by Horace Mann in 1857—"No cause, not even the highest and purest, can prosper in our day without making education its ally." Education is certainly an essential element in all social enterprises such as the Driver Education movement, with which we are here concerned.

I should like also to refer to a tripartite ultimate purpose of education—the development of (1) strong attitudes of social responsibility, (2) effective skills in meeting the problems of common welfare, and (3) definite habits of cooperation in solving vital problems so that life will be more satisfying and profitable for all.

The basic purposes of Driver Education are the same and are applicable whether instruction is being planned for high school students, college students, adults, or out-of-school youth—whether for pleasure driving or the more serious business of driving for a living. Some of these specific goals, as listed by the National Conference on Driver Education, are:

1. Developing a strong sense of personal and social responsibility for the common welfare, as it is affected by and involved in the operation of motor vehicles.
2. Developing pride in maintaining high standards of performance in the operation of motor vehicles.
3. Promoting the safe, efficient, and enjoyable use of equipment and environment, that is, of motor vehicles and highways.
4. Promoting effective habits of cooperation in meeting and solving common problems concerned with the use of motor vehicles and highways.
5. Preparing people for socially-useful vocations suited to their individual abilities, involving the use of motor vehicles.

In order to meet the needs of different students enrolled in Driver Education classes, the teacher must plan the instruction carefully by taking into account the background and experience of members of the class. It is only through such careful planning that the basic purposes of the program will be achieved.

To get some idea of the need for Driver Education, observe the unsound and unsocial practices followed by many drivers on our streets and highways, or examine the many traffic facts available. In 1954, there were 67 million licensed drivers and 53 million registered vehicles—with a predicted 85 million vehicles by 1975. Ownership and use of motor vehicles is steadily increasing; 75% of our farms are now equipped with passenger cars or trucks; 85% of our workers who live 10 or more miles from their jobs commute by passenger car; and 51% of all persons who are 14 years of age and over drive motor vehicles.

Even though the death rate per 100 million miles of travel is gradually decreasing[1], we still kill over 38,000 persons and injure millions every year as the result of street and highway accidents. In dollars alone, these catastrophies cost us over $4 billion annually.

Since traffic, therefore, plays such an important part in our everyday living, it looks as though our educators have rather clear-cut responsibilities in trying to improve these conditions. Their role becomes very significant and vital when we realize that at least 85% of our traffic difficulties involve human failures.

In the past, we have expected entirely too much from our vehicles, roadways, and enforcement officers, and entirely too little from our drivers. What would have happened if the American Red Cross had put on a campaign over 40 years ago with the sole theme "Water Kills," or public utilities had stressed to workers and the public that "Electricity Kills." The situation, in all probability, would be as it is today with traffic, when we put over-emphasis on speed by harping on "Speed Kills." *It does*—in the hands of those not prepared to handle it, just as water and electricity still do.

We didn't try to eliminate the water or the electricity but we did make an effort to educate the public on how to make these increasingly useful and pleasurable elements our servants. It is high time that we made the automobile our servant instead of having the automobile run us. Think what could happen to our traffic accident rate if, *through education*, all drivers would intelligently interpret and observe such signs as "Yield Right-of-Way" which places the responsibility on the driver to use good judgment, rather than just arbitrarily saying "stop" and hoping he obeys it. Similarly, if all drivers would use good judgment on a curve and respond to a posted sign saying "Safe Speed—45 mph," "Dead Man's Curve" could be eliminated without moving a single handful of dirt. Speed itself does not kill—it is the way drivers *use* speed that kills. "Going too fast *for conditions*" is the real cause, though speed itself is often tagged as the cause of a catastrophe.

Enforcement officers realized long ago that to get observance of traffic laws, it was absolutely necessary to get public acceptance and support. This requires a long-range educational program. Much

[1] The rate was 12.2 in 1932; 8.7 in 1942; 7.3 in 1952 and 7.1 in 1953.

progress has been made in this direction where enforcement officers have been carefully selected and trained and where there is an enlightened public.

The problem of keeping our ever-increasing number of vehicles moving safely and efficiently requires adequate highway facilities. However, this does not mean that more toll roads, parkways, freeways or other roadway facilities are the entire answer, just as traffic laws and fines alone are not enough. We must cause drivers of all ages, through education, to *want* to observe our laws and to use our roadway facilities and our vehicles with good judgment and a keen sense of responsibility.

The development of this social sense of responsibility, together with actual skill in the manipulation of a motor vehicle, constitutes Driver Education

In Driver Education lies our greatest hope for dealing successfully with the continually growing problem of man's relation to the motor vehicle. Thus, it is heartening to report to you that a consistent and significant finding in numerous comparative studies of high school age driver experience records is that Driver Education substantially reduces both accidents and traffic law violations.

State education department reports indicate that about 10,000 high schools offered Driver Education in 1952–53; that nearly 7,000 of these programs included both classroom and practice driving instruction; and that the combined enrollment in Driver Education programs exceeded 800,000 students. There is also a steady increase in the programs for adults and out-of-school youth. Since 1933, we have indeed made progress!

Definitions

Driver Education as defined by the National Conference on Driver Education, refers to all experiences provided by the school for the purpose of helping students to learn to use motor vehicles safely and efficiently.

Classroom instruction in Driver Education programs refers to those learning experiences which are provided elsewhere than in an automobile.

Practice driving instruction refers to learning experiences in Driver Education provided for the student as an observer and as a student driver in an automobile.

The purposes and objectives of Driver Education are the same in the classroom as in the motor vehicle, and may be more nearly achieved through a sequence of inter-related learning experiences involving both classroom and practice driving instruction. This is the ideal program for school, fleet, or adult commercial driving school.

II. The High School Driver Education Program

The Young Driver

There seems to be no question today about the time to offer Driver Education courses. Common agreement selects the high school period. Later on I shall discuss where in the high school program such courses should be presented. The high school age is the period when youth is eager and anxious to learn. Both muscle and mind are pliable and it is not too difficult at this time to guide, direct, and mold future driving habits and skills. It is also the most favorable time to develop the proper attitudes and understandings toward our traffic problems, for teen-age is the idealistic age—the threshold of spiritual awakening.

However, preparation for driving must begin in the kindergarten. There must be constant emphasis on the place, the pleasure possibilities, and the danger of the motor vehicle in American life. Through safety education, through social studies, through health education and related subjects in all the elementary grades, the foundations for actual driving and its responsibilities can be laid.

THIS is the eighth of ten Lectures by recipients of the David Beecroft Memorial Award, presented annually for "substantial contributions to the safety of traffic involving motor vehicles."

The Award originated in the terms of a bequest to the Society of Automotive Engineers by the late David Beecroft, SAE president in 1921.

Previous awards were made to Paul G. Hoffman, Thomas H. MacDonald, Arthur T. Vanderbilt, Sidney Williams, Rudolph F. King, Franklin M. Kreml, and W. Earl Hall.

Copies of this Lecture are available in booklet form from SAE Special Publications Department, at 50¢ a copy to SAE members and $1.00 a copy to nonmembers.

Legislation and Responsibility

Each year hundreds of individuals suggest that legislation be passed *requiring* schools to provide Driver Education. This would be an unfortunate move for many good reasons. Legislative Acts alone, no matter how well written, do not solve our perplexing problems. School subjects should be initiated and added to the curriculum as the result of the decisions of local and/or state boards of education to offer such instruction. It is much better for such school authorities to *approve* Driver Education programs and the expenditure of educational funds to help finance them, than to be forced to do so because legislation has been passed *requiring* schools to offer such instruction. School programs are always more workable when voluntarily planned by professional educators.

The responsibility for Driver Education programs must be delegated to a competent staff member in the public, private, or parochial school system, on college and university campuses, and in state departments of education. This is the only way to have an assuredly successful program and one with continuity. The leadership provided by the state

department of education has an important bearing on the quality and efficiency of Driver Education programs, particularly in local school systems.

Cost of Driver Education

When lack of sufficient funds for maintaining a Driver Education program is given as an excuse in some places, it should be remembered that the money lost through accidents *in one year* would teach 40 million high school youths to drive, or five times the total number of high school students.

The most recent study on the "Cost of Driver Education Courses" was conducted by the American Automobile Association for the entire school year of 1952–53.

The study was based on reports from 867 schools and involved the instruction of 50,080 students.

Exhibit "A"
COPY

1953 Requirements For Driver Education Teacher Certification in Indiana

A driver education instructor shall hold a valid Indiana Teacher's certificate and a valid Indiana driver's license.

To be qualified for teaching in the field of driver education a teacher shall have a minimum of 2 semester hours or 3 quarter hours in basic driver education by September 1, 1954.

Teachers who have successfully completed a one semester hour training course, prior to September 1, 1953, who have never taught the subject shall be approved no later than September 1, 1954.

Teachers who become certified for the first time on or after September 1, 1955 shall meet the minimum requirements of 6 semester hours of teaching preparation made up of driver education, traffic safety and/or general safety. The six semester hours may be entirely in driver education or a combination of credit from the three designated areas of study except that a minimum of 2 semester hours shall be in a basic driver education course.

The teacher qualification plan should provide teacher preparation in three major areas of safety education. First, DRIVER EDUCATION preparation should include such areas of study as:

(1) Basic Driver Education,

(2) Advanced Driver Education,

(3) Problem Solving in Driver Education,

(4) Seminar in Driver Education,

(5) Tests and Measurements in Driver Education and

(6) Research in Driver Education.

The second area, TRAFFIC SAFETY EDUCATION, should include such areas of study as:

(1) Traffic Regulation and Control,

(2) Fleet Safety Supervision,

(3) Highway Transportation Problems,

(4) General Traffic Engineering,

(5) Highway Safety and Traffic Control and

(6) Thesis Problems and Research.

The third area, GENERAL SAFETY EDUCATION, should include such areas of study as:

(1) Psychology of the Accident Prevention Problem,

(2) Methods and Materials Course in Safety,

(3) Organization and Administration of Safety Education,

(4) Supervision Problems of Safety in the Elementary Schools,

(5) Industrial Accident Prevention,

(6) School Shop Safety,

(7) First Aid,

(8) Course in Fire Prevention,

(9) Safety and Human Conservation,

(10) Safety Engineering,

(11) Recreation and Safety,

(12) Accident Investigation for the Police,

(13) Intersection Traffic Control,

(14) Traffic Administration and Enforcement,

(15) Supervision and Safety Education and

(16) Safe Equipment and Practices on the Playground.

4/15/54
Public Safety Institute
Purdue University

It was found that the average cost per student, including both the classroom and practice driving instructions was $31.14. This is indeed a very small sum when considering the forecasted improvement in the future driving records of these properly-prepared young drivers.

It is significant to note that classroom instruction averaged 35.5 clock hr per student, observation in a car 18.3 clock hr, behind-the-wheel practice 8.6 clock hr and miles driven 78.2 per student. These are approximately the same figures found through studies made on the first courses conducted in the early 30's. They go beyond the minimum standards recommended by the National Conference on Driver Education.

Financing Driver Education

Educators have always felt that money to finance any school subject should come from the same sources as the funds provided for the school's whole program. Many educators see grave dangers in earmarking funds for special school activities because such a practice could result in a lopsided, hodge-podge of offerings in our schools.

It is entirely in order to accept appropriate offers from outside agencies to assist in initiating a sound Driver Education program. Booster Clubs all over the nation supply funds and equipment for school sports programs; General Motors furnishes materials for school shops—to name a few precedents. It is also appropriate to charge a nominal laboratory fee for both the high school and the adult programs, that is, when the adult program is under the auspices of the high school. A fee would be paid at a commercial driving school.

Two states[2] now provide direct financial assistance to school districts offering complete programs of Driver Education. Details of these programs are available from the State Department of Public Instruction in these states.

Content, Method, and Technique

An effective Driver Education program for regular high school students *must* include both classroom and practice driving instruction. It is highly desirable to conduct both parts of the program during the same semester, that is, discuss the driving incidents in the classroom and then go out in the car and practice them.

If this procedure is not possible, then the practice driving lessons should follow the classroom sessions as soon as it is practical to schedule them. At no time should practice driving be given *before* the classroom sessions or *without* classroom sessions. Classroom work alone is better than nothing but should not be considered a Driver Education program.

Driver Education should be offered as a regular part of the high school curriculum, preferably covering a full semester, with both classroom and practice driving instruction scheduled in a manner comparable to students' classes in other subjects. While extra-curricular Driver Education activities may serve desirable supplementary purposes, they alone are not usually adequate.

It is recommended that, whenever possible, the classroom work be presented as a separately scheduled course rather than a mere integration of learning experiences in other programs. However, learning experiences in other programs, such as social studies, industrial arts, health or general science, etc., should continue to be slanted toward the safety field as valuable supplementation.

A number of schools have tried a school and home cooperative plan, whereby parents, in conjunction with the in-school classroom work, provided the practice driving. This plan has met with very little success even though the high school teacher offered special instruction to the parents.

Another plan used in several schools is to have student assistants help with the practice driving lessons. Such assistants have also been used where driver testing devices are part of the Driver Education program. If such a plan is introduced, these assistants must be carefully selected, trained, and supervised.

Still another plan for the practice driving lessons is the so-called "multiple-car plan" (wherein practice driving instruction is provided simultaneously for groups of students, each of whom uses one of several cars on a well-planned, off-street practice driving area or driving range). This approach is both interesting and promising but its effectiveness, as compared with the plan where the teacher is in the car with the student drivers, has yet to be evaluated. The "dummy car" in the classroom is being tried in several schools. In other schools, a "Drivotrainer" setup, consisting of 15 "cars" all wired and connected to recording equipment, is used in conjunction with a movie projector. The "Auto-trainer" is also being used in a number of schools. More and more time will be given in the future to teaching the use of automatic shifts, since cars of this type will supplant all others in the years ahead.

Minimum Standards for High School Courses

The National Conference on Driver Education recommended that the minimum total time for a complete high school program in Driver Education should be from 45 to 60 hr. Specifically, this amount of time is to include a minimum of 30 hr of classroom instruction and a minimum class average of 6 hr per student for actual practice driving instruction, exclusive of time in the car as an observer.

As noted before, in the cost study made by the American Automobile Association, hundreds of high school teachers found it necessary to give an average of 8.6 hr per student for the actual practice driving instruction before allowing their students to take an examination for an operator's license. They also found it necessary to spend 35.5 hr to present the classroom work adequately.

There is always a tendency for the minimum recommended standards to become the maximum accepted standards. Time will tell if the driving records of students receiving the minimum recommended time behind-the-wheel are better than the records of those not taught in our schools. If there is any easing up in standards, there is grave doubt that there will be as substantial an improvement in the driving record of future trained teen-agers such as we have witnessed in the past. Fortunately,

[2] Pennsylvania in 1952 and California in 1953.

Exhibit "B"
COPY

State of Iowa Department of Public Instruction

Jessie M. Parker, Superintendent

Des Moines 19, Iowa
March 31, 1949

Requirements for Teachers of Courses in Safe Driving in Iowa Public Schools 1949-50

Requirements for approval of teachers of courses in Safe Driving, and statements concerning their training, have been revised to meet the existing situation. They are as follows:

1. Every teacher of classes in Safe Driving in Iowa High Schools must hold a regular certificate valid for teaching in high school.
2. To be *permanently approved* for teaching Safe Driving, the teacher must have completed 10 semester hours (15 quarter hours) of credit in Safety Education, including 2 semester hours (3 quarter hours) in actual Behind-the-Wheel Driving.
3. *Temporary Approval* will be continued for 1949–50 to regularly certificated teachers who at present are approved on a temporary basis, or who by September 1, 1949, present evidence of at least 2 semester hours (3 quarter hours) training in Safe Driving.
4. Every temporarily approved teacher is advised that the Department expects steady progress on the part of the teacher toward the completion of 10 semester hours (15 quarter hours) training in Safety Education. Teachers are strongly urged to complete no less than:
   (a) 3.3 semester hours (5 qr. hrs.) by September 1, 1949
   (b) 6.6 semester hours (10 qr. hrs.) by September 1, 1950
   (c) 10 semester hours (15 qr. hrs.) by September 1, 1951.
5. The Department expects that a deadline of no later than September 1, 1952, will be established, after which no teacher will be approved unless he has the full quota of semester hours (15 quarter hours) of training in Safety Education. In any instance, it is expected that the beginning teacher will have completed his training within three (3) years after he is first granted temporary approval.
6. Schools employing teachers who have less training than that required for permanent approval will be required to sign each year such a teacher is employed a Temporary Approval Card (Form 2-SD) and file it with the Department of Public Instruction. This form is supplied and countersigned by the Supervisor in Charge of the area in which the school is located.
7. In Iowa, the Iowa State College at Ames and the Iowa State Teachers College at Cedar Falls are the only institutions offering the required amount of work and the required specific courses in Safety Education as outlined above. Teachers prepared in out-of-state institutions will be approved on the basis of transcript evidence which comes from institutions acceptable to the Board of Educational Examiners.
8. Neither Iowa State College at Ames nor Iowa State Teachers College at Cedar Falls expects to continue to offer the one-week short course or the Saturday courses which have been offered during the early transition period.
9. Each College named has prepared material describing courses and giving information concerning the requirements in Safety Education. Write Dr. A. R. Lauer, at Ames, or Professor Bert L. Woodcock, at Cedar Falls.
10. Teachers are becoming prepared faster than has been expected. Every teacher is urged to complete his training as early as possible.
11. At present about 125 Iowa high schools offer Driver Training; the Department of Public Instruction has on file the names of 196 teachers who have met minimum requirements for temporary approval. Reports from the colleges are that classes in Safety Education are full.
12. Superintendents are advised to examine carefully the recommendations offered by a candidate for teaching in the field of Safety Education.
13. Schools are advised not to make arrangements for a training car before making sure they will have an approved teacher.

comparative studies show that the number of hours devoted to actual practice driving is increasing.

Where school authorities conduct the program for adults and out-of-school youth, the amount of time spent in the classroom and for practice driving should meet at least the minimum standards recommended for regular high school students. In most adults, for experience has so proven.
instances, it will take more time in the car for older

Programs for students enrolled for remedial or refresher purposes, and for those enrolled for commercial vehicle driving instruction, must also be geared to the practical needs of those receiving the instruction.

Grade Placement

Driver Education should not be exclusively for high school seniors. The course should be placed in the school semester before most of the students reach minimum legal driving age so as to reach the maximum number of future drivers. It is at this time also that they are eager and anxious to learn. If offered at the sophomore level, most of the boys will be reached before they learn to drive elsewhere, and learn then they will anyhow!

In about one-quarter of the states, the law provides that students enrolled in approved high school Driver Education programs may receive practice driving instruction on public thorofares during the period of six to twelve months before they reach minimum licensable age. By proper grade placement of the Driver Education program, high schools in these states can capitalize on natural learner interest to make the instruction most effective.

Selecting Students for Training

The classroom part of the program should be open to all students. If the prospective enrollment exceeds available dual control car facilities and selection of students is necessary for practice driving instruction, the procedure in some schools is to use one or more of the following classifications:

1. Those who are legally old enough to get a learner's permit (if one is required by the state).
2. Those who can fit the course into their schedule.
3. Those who have the consent of both parents.
4. Those who are physically fit (meet state requirements).
5. Those who will get a job because of this training.
6. Those who are up in their studies.
7. Those who do not have a driver's license. (Retraining is a different problem).
8. Those who already drive. (These are best in a class by themselves).
9. Those who register first.
10. Those who get highest grades on a traffic and driving knowledge test. (This gives no opportunity to some of the very boys who may drive commercial vehicles. It also denies Driver Education, or it fails to assure Driver Education to those who need it the most, at least as far as their present knowledge is concerned.)
11. Those who will have access to a car. (This penalizes a certain group.)

In any event, equal opportunity to enroll in the course should be afforded to both boy and girl students alike.

Giving Credit Toward Graduation

Driver Education at the high school level should carry credit toward graduation on the same basis as other subjects in the curriculum, but to get administrators to rate it thus is a continuing problem which only public pressure can solve. (The question of whether Driver Education for college students should carry credit is a matter to be decided by each individual institution.)

If Driver Education is used as a school club or extra-curricular project, the real objectives are side-tracked. Furthermore, in the adult world, driving a car is definitely not a hobby. The goal of Driver Education is adequate preparation of *every* potential motor vehicle operator, because it is an integral part of everyday American living. Students should never be heard saying: "The course must not amount to much because it doesn't carry credit," or "It isn't very important or it would be a required subject." Making Driver Education a regular part of the curriculum, with time scheduled during regular school hours, and giving regular credit for it as a full-fledged school subject, must be the ultimate goal of every high school that values its reputation as an institution for preparing youth to meet successfully the conditions of our Age.

Securing Cars

There are numerous bases upon which cars used for the practice driving part of the Driver Education program are obtained by schools, including a loan or lease basis without charge, a rental basis with an hourly charge, a mileage charge, a per student charge, or a per semester charge.

Some school authorities, however, feel that purchasing their own cars would offer more freedom in the development and operation of their own programs. In smaller school systems, where community spirit strongly supports Driver Education, it seems likely that the schools will continue to obtain cars on a loan or lease basis without charge, while in large metropolitan areas, a trend toward purchase may be expected. This is purely a local problem.

The first city to purchase cars on a big scale for Driver Education purposes was Los Angeles. During the 1954–55 school term, 42 cars owned by the board of education will be used in the Los Angeles school system. There will be 38 full-time teachers using the cars. Four of the cars will stand by in case of needed servicing and repairs. New cars will replace the old ones every three years.

By the 1958–59 school term, 152 cars and 145 teachers will be used in the Los Angeles area. At that time, all of the eligible students desiring Driver Education will be reached through the practice driving part of the program. At the present time,

all students are required by law to complete the classroom part.

Cars for practice driving instruction should be equipped with basic dual controls, that is, extra clutch and brake pedal. (The National Conference on Driver Education recommends the manual gear-shift since most learners will be using such vehicles "in the years immediately ahead.") These controls enable the teacher to get smooth operation from the very first lesson and give the teacher control in an emergency.

If the cars are used for both Driver Education and other school purposes, the means of identifying them as training cars should be visible only during the periods in which the vehicles are used for Driver Education purposes. This can be done by a detachable or reversible sign, or a sign cover.

Whenever the cars are obtained on a lease, loan, or rental basis, an agreement should be drawn up and signed by the school or college authorities and the leasing, loaning, or renting agency in which the conditions of the lease, loan, or rental are clearly set forth.

Insurance

The importance of adequate insurance coverage for practice driving instruction cannot be over-emphasized. The policy should always include all concerned with the program along with the car.

When Driver Education courses were first started, the insurance premium was twice the regular passenger car rate and, in some cases, even higher. It was not until the program was in operation for five years that the rate was reduced to the regular passenger car rate. This was done because of the very favorable accident experience with these cars.

Many of the insurance companies today charge as high as 30% extra premium on insurance policies when individuals 20 years of age and under operate the family vehicle. In some cases, the extra premium is added for persons 26 years of age and under. In 1953, this added insurance premium on policies where there were the younger operators amounted to $60 million. This is the amount of money needed to furnish a top-quality Driver Education program (including both classroom and practice driving instruction) for every student reaching legal driving age in our high schools each year.

However, some enlightened insurance companies are now issuing policies at the regular adult rate or even reduced rates, provided the individuals operating the vehicles have successfully completed a high standard high school Driver Education course.

This is the direct result of the favorable accident experience of those completing the high school instruction.

It is entirely possible that the time may come when insurance rates will be based initially, at least in part, upon the amount of preparation that the applicant has had, and will subsequently vary with his re-training and driving experiences.

Results

Have the Driver Education courses in high schools been of any real value? This is the question often asked by the skeptics who still believe our schools should stick to the three R's. Many studies have been made to determine the value of these programs. Here are a few examples of the results:

1. Cleveland, Ohio

3252 students checked—one-half received the instruction in high school—one-half did not receive such instruction. The group receiving the instruction had only one-half as many accidents as the group not receiving such instruction.

2. State of Delaware

2186 students checked—one half received instruction—one half did not receive such instruction

Boys	617 Instructed in H.S.	617 Not so Instructed
Warnings issued per 100 drivers	37.3	48.8
Accidents per 100 drivers	28.0	44.2
Arrests per 100 drivers	55.6	77.8
Licenses suspended per 100 drivers	0.6	3.2

Girls	476 Instructed in H.S.	476 Not so Instructed
Warnings issued per 100 drivers	3.6	9.7
Accidents per 100 drivers	5.7	10.1
Arrests per 100 drivers	4.4	5.9
Licenses suspended per 100 drivers	0.2	0.0

3. State of Vermont

418 students checked—one-half received the instruction—one-half did not.

	Instructed In High School	Not so Instructed
	(209)	(209)
a. Convictions	0	10
b. Accidents	4	29

4. Commonwealth of Pennsylvania

3,000 students checked—one half received the instruction in high school—one half did not receive such instruction

Boys	Instructed in High School	Not So Instructed
Arrests per 100 drivers	2.2	7.7
Accidents per 100 drivers	4.4	9.9

Girls	Instructed in High School	Not So Instructed
Arrests per 100 drivers	0.4	0.5
Accidents per 100 drivers	1.6	3.0

California, Colorado, Ohio, Washington, D. C., Wisconsin, and others report 40 to 50% fewer viola-

tions and accidents by those who were high school trained. Surely this is ample evidence that these courses are paying off.

Public Relations

Public apathy will, no doubt, always be with us to some extent. But once the great majority of the public supports Driver Education wholeheartedly, the results are amazing. The continued acceptance and appreciation of the value of the Driver Education program on the part of the public depends on the quality of drivers prepared through this program. Such activities need enlightened public support if they are to be a part of the entire community program. For this reason, school authorities should maintain close cooperation with local law enforcement officers, department of highways, driver licensing authorities, public safety department, state police, automobile clubs, insurance companies, safety councils, and other official and unofficial groups—for technical advice and assistance, and for coordination of the school or college program with the community safety effort. A definite program should be developed and carried on to utilize effectively the facilities and personnel resources of these groups.

Cooperation should also be enlisted from the press, radio, television, and advertising media, safety-interest groups, public and private agencies, parent-teacher associations and other community groups.

One excellent source of cooperation is the enlistment of ministers, priests, and rabbis for sermons on the idea of the "brother's keeper" responsibility in traffic.

Lay advisory committees have also been formed to furnish an effective means for improving the program in some communities. These groups could well become booster clubs for Driver Education for either school or adult programs. The representatives on such committees must be carefully selected in order to get maximum benefit from their services.

The much better violation and accident experience of those receiving Driver Education in high school or college can be utilized effectively in obtaining active cooperation of key groups in the community—and thus, stimulated favorable public opinion can demand adherence to high standards should schools grow lax.

Records and Reports

It is good business for school systems and institutions of higher learning offering Driver Education to record all significant information concerning the program. Such data should include the activities of both the students and teachers as well as all information on the use of the automobile.

Teen-Age Conferences

The high school is the clubbing age; the group spirit prevails. Youth is on fire for action, and if environment and teaching have melded properly, the intelligent average boy and girl sees the evils of the hour and wishes to do something constructive about them. They have *ideas* about traffic—they should be heard. Especially those who have finished a Driver Education program have much to offer.

Conferences on a local, regional, or state-wide ba-

Exhibit "C"
COPY
Commonwealth of Pennsylvania
Department of Public Instruction
Harrisburg
January 15, 1948

To Presidents of Accredited Colleges and Universities, County and District Superintendents:

At the meeting of the State Council of Education, January 9, 1948, the following regulations were passed for the certification of teachers in the field of Education for Safe Living (Highway Safety and General Safety Education):

I. Temporary Standard Certificate

A. A temporary standard certificate valid for two years will be issued to an applicant who meets the following requirements:
   1. Holds a valid certificate to teach
   2. Has completed three semester hours in the field of Highway Safety Education (Driver Education and Training) at an institution specifically approved for this type of preparation.

II. Permanent Standard Certificate

When the applicant has completed six semester hours (three semester hours in Highway Safety Education and three semester hours in General Safety Education) at an institution specificially approved for this type of preparation and has completed two years of successful experience in the field, the certificate will be made permanent.

III. Effective Date

1. These regulations will be effective September 1, 1948
2. Effective September 1, 1950, nine semester hours will be required in the field of Highway Safety Education (Driver Education and Training and General Safety Education) for the extension of a teacher's certificate to cover this field; in 1951, twelve semester hours will be required for the extension of a teacher's certificate to cover this field.

Very sincerely yours,
/s/ Henry Klonower,
Henry Klonower, Director
Teacher Education and Certification

sis have been held in California, Colorado, Florida, Georgia, Iowa, Pennsylvania, Maryland, Michigan, Rhode Island, Texas, and Wyoming. They have put their elders on the carpet and we should take heed.

III. The Teacher

Teacher Qualifications

Just because "it fits into his schedule" should not cause any administrator to appoint an unqualified teacher to the instructor's position. Only specially trained persons should handle this work. As music courses need specially-qualified persons, so does this program. Teachers of Driver Education should be selected by the same basic standards as are used by school authorities when selecting teachers for other school subjects.

Salaries and promotions of Driver Education teachers should be commensurate with those of other staff members with equal preparation and experience.

The teaching load in hours and work carried by Driver Education teachers should be comparable to that of other staff members. Even though a Driver Education teacher has only four or fewer in a car for practice driving instruction, it should be clearly understood that this requires just as much work effort by the instructor as a comparable period of classroom teaching in any other subject.

School officials, and the Driver Education teachers themselves, should also recognize the exacting nature of practice driving instruction, and, therefore, the consequent lowering of overall efficiency of these teachers when they assume after-school, evening, and Saturday teaching duties, which many feel compelled to do to reach an adequate income.

Some of the basic qualities and necessary qualifications for one to do an effective teaching job in the high school Driver Education field are as follows:

1. Must be enthusiastic about the possibilities of accomplishment in this field, the ultimate improvement of traffic conditions, and the actual reduction in accidents.
2. Should have above-average driving ability as evidenced by the passing of an approved test administered by a qualified official, as well as a record of no accidents within the last two years for which he or she was responsible, and without repeated moving violations.
3. Should have at least 3 years of driving experience and at least 30,000 miles in distance.
4. Should be familiar with the nature and needs of adolescents.
5. Should be even-tempered, sympathetic, have unusual patience, and not be easily excited or angered.
6. Must be able to organize teaching material, and to give interesting lectures and demonstrations.
7. Must possess a high degree of emotional stability and behave rationally. Experience has shown that women are as successful as men when properly selected and given equal opportunities.
8. Should possess keen imagination, the experimental viewpoint, and realize the job is individualistic in nature.
9. Should be old enough to command the respect of any learner, should be active, and not so old as to be fixed in his ways. The average age range is from 21 to 45.
10. Must adhere to standards, be industrious and business-like, and must not permit waste of time.
11. Should be in good physical condition, including good eyesight, satisfactory hearing, and no serious physical impairment.
12. Should not be selected solely because of expert knowledge of auto mechanics, although such knowledge is helpful.

Teacher Preparation

The success of a Driver Education program, regardless of the age group taught, depends to a great extent on the professional preparation of the teacher. Such preparation should include at least one course in general safety education and a basic course in Driver Education. A teacher will do no better in this field than in any of the other school subjects without proper preparation in the specific field.

Teachers' colleges and schools of education in other institutions have accepted their responsibilities by providing professional courses for teachers of Driver Education. It is a far cry from our first course in Driver Education for high school teachers for college credit in 1936 at the Pennsylvania State University to 278 courses in 1954. Including courses in general safety, there were altogether 622 offered at 340 colleges in the 48 states this past academic year.

During the preparation of Driver Education teachers, the program should afford each teacher an opportunity to actually instruct a beginning driver from "scratch" on how to drive safely and efficiently. The beginning driver should be in the same age group that the teacher expects to have in the class. If the instructor is going to teach adult beginners, school bus drivers, commercial vehicle drivers, or merely a group of licensed drivers who desire improvement instruction—then the preparation should be in terms of that group.

Colleges and universities should provide both pre-service and in-service teacher preparation in Driver Education. The pre-service program should be on a long-range basis and should be a part of the general program of our educational institutions, if Driver Education teachers are to be well-prepared for this work. The in-service programs, most needed by present Driver Education teachers, are extension courses, seminars, conferences, clinics, institutes, workshops, and advanced courses in Driver Education.

Driver Education teachers should also organize their own groups and hold sectional or state meetings as a means of promoting their own professional growth and improvement. Where now so organized, the Driver Education meetings are usually held in conjunction with state educational meetings.

Course content for the different programs is available from the Institute of Public Safety, The Pennsylvania State University, State College, Pennsylvania; the National Commission on Safety

Education, 1201 Sixteenth Street, N. W., Washington, D. C.; the American Automobile Association, 1712 G Street, N. W., Washington, D. C.; and the Center for Safety Education, New York University, New York City.

Teacher Certification

It is recommended that state departments (or state teacher certification agencies) certify only those prospective teachers of high school Driver Education who have satisfactorily completed at least a course in general safety education, plus a basic teacher's course in Driver Education.[3]

In addition, the driving records, aptitude, and potentiality for effectively teaching Driver Education should be carefully checked *before* certification, to determine whether the prospective teacher can qualify. These requirements should apply equally to prospective teachers of either classroom instruction or practice driving instruction.

IV. Other Types of Driver Education Programs

Adult and Out-of-School Youth

Many of our high schools are offering Driver Education courses for adults and out-of-school youth without substantially increasing the facilities and the equipment required for the regular school course. Such programs must be carefully planned so as to meet the special needs of adults and out-of-school youth concerned.

In commercial schools there is found to be about 1,000,000 enrollees annually. As more and more of the teen-age group is trained in high school, this other group will diminish greatly.

An adult may undertake the driving of a motor vehicle for the first time as a result of a change of residence or job, the acquisition of his first car, or because of any number of circumstances.

Others will enroll because they lack confidence in traffic or they may simply seek some advanced instruction, while a few wish to prepare for some kind of vocational or commercial vehicle driving.

One factor always to be remembered by instructors in this category is the difference between the instruction given to high school students and that given to adults. From presentation to examination, the psychological approach is varied.

Commercial driving schools may soon be staffed with teachers qualified and licensed by the state department of education, thus enabling the state to supervise curricula and instruction. Some such schools already employ the group method, and more schools are being organized and operated by former high school Driver Education teachers. Some communities enjoy Automobile Club driving schools. Departments of recreation also conduct driver preparation programs much on the order of "swimming for everybody."

College Students

One of the neglected groups in our Driver Education program is the college student group—an age bracket with a definitely bad driving reputation. Certainly it is the responsibility of each educational institution of higher learning to provide this opportunity for those who have been passed by in their high schools. Many times outstanding students are killed or seriously injured at the very dawn of their careers.

Traffic Violators and Accident Repeaters—When a driver constantly violates the law or has accident after accident, an effort should be made to find out the reasons why. Such attempts are being made in Chicago and Detroit, for example, where full-time psychiatrists are on the staff of the traffic division of the police departments.

A unique program is also being tried out at the Traffic Institute at Northwestern University, whereby officers in training are given special instruction on how to obtain more detailed personal information concerning drivers involved in accidents. Such information includes when trip was started, how long at the wheel, how long asleep previously, any unusual occurrences during the trip, and so forth. Such research information should prove helpful in planning future traffic accident prevention programs.

Special schools have also been conducted for traffic violators and accident repeaters in Pittsburgh, Phoenix, Greeley, Los Angeles, and many other cities. The success of these schools is evidenced by the low percentage of offenders who are returned for more instruction.

Such schools should be a part of the traffic division of the police department in all of our cities. They are especially helpful to teen-age drivers caught in their first brush with the law. If the traffic school is open to the public, then violators are not conspicuous and resentment is eased. We should give our traffic violators, accident repeaters, and others an opportunity to be taught, before administering heavy fines, or suspending or revoking their licenses. The ultimate success of such schools, however, will depend upon the teacher, his training, enthusiasm, character, personality, and particular ability to adapt to the varying needs of the people in his classes. The future should see great advancement here.

Commercial Drivers—A national program for motor vehicle fleet supervisors to aid in the selection, training, and supervising of commercial vehicle operators has been in existence since 1939. This cooperative effort has expanded until special instructional courses are now offered by some 40 colleges and universities in the United States, Canada, and the Hawaiian Islands.

The program is conducted under the guidance and direction of the National Advisory Committee for Motor Fleet Supervisor Training. This Committee is made up of representatives from 16 national organizations interested in this type of training.

There are over 7 million commercial drivers in the United States, so the impact of this offering will be far-reaching as the materials and methods learned about in these courses for selecting and training new drivers, and retraining present drivers, are introduced in local fleets. Already, hundreds of fleet owners have reported reductions in

[3] See Exhibits "A," "B," and "C" at the end of this paper for teacher certification requirements in Driver Education in Indiana, Iowa, and Pennsylvania.

accident and insurance rates, lower per mile cost of operation, and improved public relations since inaugurating the fleet driver improvement program.

Through one special effort, known as "Effective Fleet Operation," an attempt is being made to reach operators with only a few pieces of equipment. These courses are offered at locations and times suitable to small operators, and should aid them greatly.

There are several schools operated exclusively for the training of commercial drivers. These are located at The North Carolina State College; Bedford, Pa.; Detroit, and Los Angeles. Driving commercial vehicles is an exacting vocation and should be so recognized.

Federal funds are available for vocational school education, and the Los Angeles area public schools have already introduced courses for commercial drivers. At present, there is a cooperative program run by fleet owners and the union in testing drivers in Los Angeles. This project has been very successful and there is every indication that the next step will be actual training.

School Bus Drivers

Each year thousands of school bus drivers transport millions of school children safely to and from school. Their enviable records did not just happen. In the school districts where these accident-free records are common, there is usually an excellent program for selecting, training, and supervising school bus drivers. More such programs are needed if we are to continue transporting the growing number of rural children safely to and from school in increasingly heavy traffic.

One state requires a refresher course every year—an idea that could be copied profitably by others.

Drivers of Small-Powered Vehicles—Scooters and Powered Vehicles

There is real need for an educational program for drivers of scooters and powered vehicles, for the death and injury rate increases every year through growing use of such vehicles. The small vehicle has small chance in the battle royal of the highways. At the present time, there seems to be no effort in their behalf. This is certainly another responsibility of our schools.

Drivers of Bicycles

Since bicycle riders are classed as drivers and are required to obey certain basic motor vehicle regulations, they should also receive special instruction on how to manipulate a bicycle safely. Such instruction is available through the police departments in White Plains, N. Y.; State College, Pa.; Mansfield, Ohio; and many other cities. Many schools have bicycle clubs through which some learning is attained. There are also excellent films and booklets available from national organizations to aid in educating bicycle drivers as to their rights and responsibilities in traffic.

V. Research

Progress in any field depends very much on the results of carefully conducted evaluation and research studies. Driver Education is no exception. The effectiveness of Driver Education programs should, therefore, be measured and evaluated for each school to determine the adequacy of the program, and if it is meeting the stated objectives.

Continued progress requires the cooperative efforts of research centers and research-minded individuals. The methods and techniques used, for example, in high school Driver Education courses have undergone few changes during the past 15 years. Very little, if anything, has been done to determine if such methods and techniques have been effective in attaining desired student development. It is only through careful research that we get the *real* answers to such problems and are able to project our programs intelligently into the future.

Finally, there is a need for basic research on drivers, such as looking into human reactions, states of mind, wrong and right emergency habits, hazards and similar problems.

Far-sighted leaders in the field, including the National Commission on Safety Education, the American Automobile Association, and the Highway Research Board, have developed extensive lists of current research needs in Driver Education.

VI. The Future of Driver Education

It is not necessary to use a crystal ball to prophesy the future of DRIVER EDUCATION. The return to NO EDUCATION is as unthinkable as the return to the kerosene headlight. Driving is not only "in" in education, but civic and industrial leaders regard it as an essential activity worthy of careful education.

Some school administrators considered it to be one of the "frills" in education to be dispensed with for the duration of World War II; but Driver Education is not likely to meet such a fate again for one out of every eight men in the armed services manned automotive equipment during the war, with still another trained man alerted for each piece. Teaching the manipulation of motor vehicles is now known to be a significant contribution in time of war.

Of the 27,000 high schools in the United States, over 7,000 had practice driving cars and conducted complete Driver Education programs during 1952–1953. The rapid pace of expansion is likely to level off, but continuing growth is certain. Over 3,000 others gave at least classroom instruction and laid the groundwork on which future programs will grow. In Pennsylvania, the number of schools using cars increased nearly 20% in one year. Because of the skills needed in automotive repair, vocational schools recognizing the need are adding auto mechanics to their curricula. Gradually they are doing the same for those wishing to make their living driving motor vehicles. It is from these schools that the smaller trucking companies, as well as other businesses needing drivers, can obtain ready and well-prepared personnel.

Problems to Be Solved

Aside from the continuing basic problems of administration, organization, personnel, equipment, research and the like already mentioned, a few

others should be noted with which to cope in the future.

1. An abuse is creeping into the program through the misuse of the practice driving car, because the availability of the car often tempts school personnel to borrow it, with or without advance approval, for purposes other than Driver Education.

2. In regard to state control—supervision and advisory aid for Driver Education are noticeably lacking on the state level, but a few states are pioneering in this field. Departments of Education are working toward the goal of complete Driver Education in every high school in the state. In Pennsylvania, the learner's fee has been raised from $2 to $4 in order to help finance its Driver Education program. The Department of Public Instruction receives the extra amount and in turn reimburses each school to the extent of $10 for each pupil trained, in addition to the regular reimbursement for part of the teacher's salary. This should set a precedent.

3. State examiners for drivers' licenses show too great differences in technique.

4. New teachers are left too much on their own after attending a basic course, and sometimes are in great need of refresher courses and help on specific problems.

5. Some high schools offer the course primarily to enable students to get drivers' licenses. A license is no guarantee that the holder is a good driver.

6. The lack of adequate equipment sometimes stymies the course. We have only to realize what a home economics course would be like without a stove to see what happens with a similar lack of automotive equipment for Driver Education.

Several general suggestions for the future might be appropriate here:

1. States might work out a probationary period for newly-licensed drivers—until 21 for young novices, a two-year period for adults. This should tend to hold in check somewhat those who have not had the opportunity for guided learning.

2. If all states would make an honest effort to truly examine the fitness of each applicant for a driver's license as to his ability to handle a motor vehicle, *and* endeavor briefly to plumb his depth of social responsibility as well as take stock of his physical fitness (epileptics can obtain licenses in some states), we would be many accident-free miles ahead. Even if each state tightened up just a little more, it would help. This, in time, would almost force applicants to take a Driver Education course.

3. More than one state has found itself doling out a blindness pension and issuing a driver's license to the same individual. One rural resident I know of always took his wife along to tell him when a car was approaching. Perhaps periodic re-examinations would be the answer to many such conditions, and abuses of the automatically-renewed (for a fee) license. Certainly, many who passed their examinations 20 years ago could not pass them now.

Opportunities for Trained Teachers

Openings galore present themselves for any well-trained Driver Education teacher:

1. A choice is offered in some places between teaching either classroom work or road work.

2. Anyone may work toward the position of the safety director for the school system. Eventually, every school system will have one. Consolidated schools are greatly in need of such a coordinator and supervisor, with their increasing school bus transportation.

3. There has been rapid increase in the number of commercial schools, with the accompanying demand for instructors.

4. There is a strong possibility of the state using the high school teacher as a driver examiner.

5. Many Driver Education teachers already are part-time consultants on driver selection and training for small taxicab, truck, and bus companies.

6. Colleges are using the services of qualified high school teachers to conduct college courses in safety education during the summer sessions.

7. More safety centers, institutes of public safety, extension courses in driving, and the like, will demand trained individuals to head and staff them.

8. There is a need for directors of safety education in state departments of education, and probably for field assistants, too. Only a few states now have such positions.

9. Traffic schools conducted by courts or municipalities need trained personnel. These will increase.

10. A coveted position is that of traffic court diagnostician. This official would be both driver educator and psychologist. His aim would be to discover the offender's disabilities or weaknesses and map out a course of rehabilitation, with tests to check on progress.

To a great extent, the future success of Driver Education rests in the hands of Driver Education teachers. But they alone cannot light the way in the traffic safety crusade. Enthusiasm will die unless these teachers are backed up by far-sighted administrators, and the continued vision, expenditure of precious resources, determination, and enthusiasm of non-school agencies.

Men and women selected for Driver Education work may well feel a personal dedication to the cause of improving traffic conditions and reducing the destruction, suffering, and death that today plague America's streets and highways. Their hands hold the key to

"SAFETY FOR GREATER ADVENTURES."

About SAE

LT. GEN. DOYLE O. HICKEY (RETIRED) will serve as executive vice president of Continental Motors Corp. and manager of the newly formed New Products Division in Detroit. Gen. Hickey recently retired from the Army after long and distinguished service in Key Command and staff assignments.


Hickey


Roberts

WILLIAM A. ROBERTS, president of the Allis-Chalmers Mfg. Co., Milwaukee, has been named as a member of the Special Advisory Committee on a National Highway Program by President Eisenhower. The committee will be headed by Gen. Lucius D. Clay and will work closely with the special Governors' Conference committee which also is studying ramifications of President Eisenhower's proposal for a greatly expanded highway construction program during the next decade.

F. C. RUSSELL is the author of **Fred Russell's Car Care**, recently published by the Arco Publishing Co. Written for the car owner, this book helps the motorist detect and trouble shoot malfunctions. It also gives the "do-it-yourself" enthusiast instructions on how to work on his own car. Russell is a regular contributor to **Mechanix Illustrated** and has many other technical automotive articles aimed at the motoring public.

JOHN W. KELLY has been appointed vice president in charge of engineering for Adel Precision Products Division of General Metals Corp., Burbank, Calif. He has been in administrative charge of engineering at Adel for the past 14 years.

HOWE E. HOPKINS is now employed in Pau, France as staff engineer of the Turbine Division of Continental Aviation and Engineering Corp. Formerly he was chief engineer of Constant Compression Engine Co., of Chester, Pa.

JOHN H. STICKNEY, formerly industrial sales engineer in northern Indiana for The Parker Appliance Co., Cleveland, Ohio, has been given enlarged responsibilities as sales engineer for Parker o-rings and related rubber products in northern Indiana, central Illinois, and the entire states of Wisconsin and Minnesota.

CLIFFORD J. NUTTALL, JR. is now president of Wilson, Nuttall, Raimond, Engineers, Inc., Chestertown, Mo. This is a new engineering company offering engineering testing, evaluation and development services on all types of automotive equipment. He was chief, Motor Vehicle Research Division, Stevens Institute of Technology, Experimental Towing Tank, Hoboken, N. J. **CHARLES W. WILSON**, member of this new company, was assistant chief, Motor Vehicle Division.


Wagar


Parker

T. E. WAGAR recently retired as chief electrical engineer, Studebaker Corp., South Bend. He has been a member of the SAE Electrical Equipment Committee since 1944 and was its Chairman in 1953. He has also been a member of the Lighting Committee since 1942. **CHARLES J. PARKER**, member of the Studebaker Corp.'s engineering staff for twenty-nine years, has been elected to succeed Mr. Wagar.

NORMAN C. WITBECK has joined the development engineering staff, Fairchild Engine Division, Fairchild Engine and Airplane Corp. of Farmingdale, L. I. He handles special-purpose aircraft powerplant projects. Previous to this he was executive director, Panel on Aircraft Propulsion, Department of Defense, Pentagon, Wash.

CLEEMAN WITHERS has been elected vice president in charge of manufacturing, engineering, and sales of the Jacobs Aircraft Engine Co. Previous to this election, he was sales manager of the Pacific Airmotive Corp., Aircraft Division, Burbank, Calif.

JOSEPH M. STURM has taken the post of project engineer for Chrysler Corp. in Detroit. He had been a test and development engineer at Chrysler Proving Ground in Chelsea, Mich.

ARTHUR E. RAYMOND, vice president in charge of engineering and director of Douglas Aircraft Co., Inc., Santa Monica, Calif., and SAE Councilor for the term of 1946-1947, has been named to receive the Spirit of St. Louis Medal.

This award, which is administered by the Board on Honors of The American Society of Mechanical Engineers, is conferred for meritorious service in the advancement of aeronautics. It was established by the citizens of St. Louis in 1929.


Raymond


Kimball

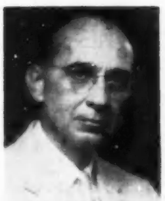
DEXTER S. KIMBALL, JR. has been elected an alumni trustee of Cornell University for a five-year term beginning July 1, 1954. Mr. Kimball is vice-president, general manager, and a director of Bendix-Westinghouse Automotive Air Brake Co. with offices in Elyria, Ohio.

Members . . .

B. E. HUTCHINSON, chairman of the finance committee of Chrysler Corp., has accepted the chairmanship of the Automotive Division of the Committee of American Industry. Serving with him as co-chairman will be **COL. W. F. ROCKWELL**, chairman of the Rockwell Spring and Axle Co. Other SAE members on the committee are **EDGAR F. KAISER**, president of Kaiser Motor Corp. and **H. J. McGINN**, president of Reo Motors, Inc.

C. T. (MIKE) O'HARROW has been named assistant chief tractor engineer of the Tractor and Implement Division, Ford Motor Co., as announced by **DALE ROEDER**, chief engineer of the division. Mr. O'Harrow, SAE Vice-President representing Tractor and Farm Machinery in 1953, will take active part in the establishment of the major engineering center for tractors and farm equipment in Birmingham as assistant to **HAROLD L. BROCK**, chief tractor engineer.

O'Harrow



Dickson

JOHN B. DICKSON, member of the SAE Lighting Committee, has been appointed chief engineer in charge of Lamp and Lens optical design and development with Signal-Stat Corp., Brooklyn. He had been lighting engineer with Chrysler Corp., Engineering Division, Detroit, for 20 years prior to this appointment.

WATSON I. FORD, chief tire engineer of the Tire Development Department, U. S. Rubber Co. of Detroit, has been newly elected controller of the Ohio, Indiana, Michigan regional branch of the United World Federalists. The branch was recently formed to provide professional staff service to the entire area, in order to support UWF work in building public sentiment for a strengthened United Nations empowered to halt aggression.

Ford

Zurn

FRANK W. ZURN has been appointed manager of engineering sales for the J. A. Zurn Mfg. Co., American Flexible Coupling Co. of Erie, Pa. He has been working in this field for several years since graduation from the Mechanical Engineering School of Cornell University.

JOHN W. WEAVER, who was sales manager, Casting Division, Waukesha Foundry Co., Waukesha, Wis. has been named to the office of vice president in charge of sales, Foundry Division.

EUGENE E. SILVA is now engineer-in-charge at the Arcadia Equipment Development Center in Arcadia, Calif. He was formerly equipment engineer with the U. S. Forest Service in Missoula, Mont.

McCarthy

CHARLES J. McCARTHY has been elected chairman of the board of directors of Chance Vought Aircraft, Inc. The election of Mr. McCarthy, formerly a vice-president of United Aircraft Corp. and at one time general manager of the former Chance Vought Aircraft Division of UAC, was announced following a meeting of the CVA board. He has resigned as an official of United Aircraft.

On July 1, Chance Vought Aircraft, Inc., became a completely independent manufacturer of aircraft and guided missiles, with an independent board of directors and no futher legal or corporate connection with United Aircraft.

DONALD JAMES STROOP has taken a job with the American Institute of Chemical Engineers as space salesman on their publication, "Chemical Engineering Progress." He had been in the Sales Engineering Department of Baldwin-Lima-Hamilton Corp. in New York.

GORDON R. McGREGOR, retiring president of the International Air Transport Association expressed his views concerning the future roles of new turbo-prop planes at the September general meeting of the I. A. T. A. in Paris. He asserted to the delegates that "the day of the gas turbine engine in aviation of all types is now emphatically here." He feels that turbo-prop powered air liners will prove to be at their best on short and medium-length routes, and although the future of air transportation in long-haul flying "seems to lie with the pure jet engine," he is keeping an open mind while observing both turbo-prop and pure jet developments.

JOHN J. HOSPERS received life membership in the Dallas Chamber of Commerce September 17. Only five other men in the chamber's 80-year history have been honored with similar life memberships. Life membership in the chamber is earned by a volunteer worker who signs up 100 new members within a 12-month period.

Hospers is customer relations representative with Chance Vought Aircraft, Inc.

Delco-Remy Changes


Phelps


Bolles


Bardsley


Hartzell


House


Staggenburg


Kendall

The Delco-Remy Division of General Motors Corp. in Anderson, Ind. has recently announced a number of position changes involving SAE members.

In this announcement, **ARTHUR G. PHELPS**, who has been general sales manager, becomes executive assistant to the general manager. The former chief engineer, **J. H. BOLLES**, is taking the position of director of sales and engineering. **P. EDWARD BARDSLEY** is sales and service manager. He was assistant. **HERMAN L. HARTZELL**, who was assistant chief engineer, has become chief engineer. **PERRY W. HOUSE** takes over Hartzell's position as assistant chief engineer. He was engineer, metallurgist and materials. **HERMAN J. STAGGENBURG** was appointed manager of Delco Battery Operations, having been assistant manager, and **THOMAS L. KENDALL**, who has been chief engineer of Delco Battery Operations, was appointed director of battery engineering and replacement battery sales.

WILLIAM A. FURST is now employed by O. E. Szekely & Associates, Inc. of Philadelphia in the position of project engineer, design and development. He had formerly been factory manager for Teleflex, Inc. of North Wales, Pa.

ROLLIN F. ALLYNE, Treasurer of the Colorado Group in 1950, is a transportation refrigeration engineer with the Liquid Carbonic Corp. in Chicago. He had been a sales engineer for Hunter Manufacturing Co. of Cleveland.

DOUGLAS E. HOLT, who had been design engineer (mechanical) for the Heil Co. of Milwaukee, has joined the Industrial Engineering Institute, Engineering Division, also in Milwaukee, as chief engineer.

CHARLES L. DITTOE is now an experimental test engineer of the Allison Division of General Motors Corp. in Indianapolis. He was formerly employed as research engineer in the GMC plant in Detroit.

FREDERICK P. GLAZIER, who had been employed by the Texas Co., has joined the Wright Aeronautical Division, Curtiss-Wright Corp., Wood-Ridge, N. J. as staff engineer.

MANTON L. SHEEHAN is now a sales engineer with Harvey Machine Co. of Torrence, Calif. With Parker Appliance Co. of Cleveland, he had been district manager.

S. A. C. WITTEN has joined the Faber Laboratories of Los Angeles as field engineer. Previous to this he was manager, technical service, of Bardahl Lubricants Ltd., in Montreal, Quebec, Canada.

ROBERT W. CONNOR has recently joined the Ford Motor Company engineering staff as engineering program coordinator with the Engineering Research Department at Dearborn, Mich. Mr. Connor was formerly on the technical data staff of the Chevrolet Central-Office Engineering Department in Detroit, Mich.

MAXWELL B. JESTER, who had been with the Calumet Refining Co., Chicago, has joined Rubarite, Inc., also of Chicago, as field and research engineer.

JOHN R. MORROW, who was sales engineer for the Muskegon Piston Ring Co. of Detroit, has joined the Kaydon Engineering Corp., also in Muskegon.

R. BRUCE UNDERWOOD recently accepted the position of project engineer for the Peter Smith Heater Co. of Detroit. Formerly he was employed in the same capacity with the Southwest Research Institute of San Antonio, Texas.

RALPH W. DONLEY has recently accepted a position as engineer in the Automotive New Devices Engineering Department of Bendix Products Division of Bendix Aviation Corp., South Bend, Ind. Previously he was new development design engineer, Ross Gear and Tool Co., Lafayette, Ind.

Kasschau

KENNETH KASSCHAU has been named manager of the American Locomotive Co.'s Atomic Energy Department, Schenectady. He was formerly the director of the Research and Medicine Division, Oak Ridge Operations for the U.S. Atomic Energy Commission.

RALPH EDWARD TUTTLE has joined North American Aviation, Inc. of Los Angeles in the position of research engineer, rocket engines. He had previously worked with the Lord Manufacturing Co. of Erie, Pa. as product engineer.

ANDREW W. ZMUDA is now working with the Buffalo division of the Houdaille-Hershey Corp. as chief engineer. Previous to this, he was a senior engineer in the Buick Motor Division, General Motors Corp., in Flint, Mich.

CLAYTON W. KERR is now with the Collins Radio Co. of Cedar Rapids. He had been supervisor, engine specifications, Cadillac Motor Car Division, General Motors Corp., Cleveland Tank Plant, in Cleveland.

STANLEY C. TARRANT has become resident experimental engineer at General Motors Proving Ground, Milford, Mich. He was experimental engineer at the same address.

J. ALLAN MacLEAN has been named manager of the automotive products section of the Bendix Aviation Corp. at South Bend. He was recently director of industrial relations for this South Bend division.

MacLean

Thomas

CALVIN T. THOMAS has been named manager of the Transportation Department of the General Petroleum Corp., Los Angeles, Calif. He had been manager of Automotive Equipment for the Marketing Department.

Students Enter the Service

U. S. Army

- Pvt. **HUGO BEIT**—Fort Dix, N. J. (Yale '53)
- Pvt. **RUDOLPH HOHENBERG**—Fort Dix, N. J. (Stevens Institute of Technology)
- Pvt. **WILLIAM O. KUHNS**—White Sands Proving Grounds, N. M. (General Motors Institute '53)
- **EDWARD J. LONGNECKER**—Fort Knox, Ky. (Michigan State College)
- Pfc. **WILFORD E. MAPLES**—Army Chemical Center, Md. (General Motors Institute '52)
- **RICHARD G. MURPHY**, Instructor—Fort Sill, Okla. (Academy of Aeronautics '53)
- **JOSEPH A. NAUGHTON**, Electrical Engineering Assistant—Fort Knox, Ky. (Notre Dame '51)
- **JOHN W. SCHEJBAL**—Chaffee, Ark. (Missouri School of Mining and Metallurgy '54)
- Lt. **PHILIP H. WILLIAMS**—Fort Knox, Ky. (Utah State University '53)

U. S. Navy

- Ens. **CHARLES J. BERTHE, JR.**—Naval Air Station, Pensacola, Fla. (University of Oklahoma '54)
- Ens. **WILLIAM F. BLACK**—Naval Station, San Diego, Calif. (Stevens Institute of Technology '52)
- Ens. **STEPHEN P. CUFF**—Portsmouth Naval Shipyard, Portsmouth, N. H. (Stevens Institute of Technology '53)

U. S. Air Force

- Lt. **EMANUEL A. FISCHBERG**—Wright-Patterson Air Force Base, Ohio (Yale '54)
- Lt. **JOHN MAJANE**—Wright Field, Ohio (Rensselaer Polytechnic Institute '53)
- 2nd Lt. **DONALD R. SHOVER**—Fort Knox, Ky. (Ohio State University '54)

U. S. Marines

- 2nd Lt. **C. S. ISHERWOOD**—Quantico, Va. (Yale '54)

CLARENCE W. LAUBIN has joined the Stratos Division, Fairchild Engine & Airplane Corp., Bayshore, N. Y. as chief design engineer. He had been chief mechanical engineer for Nagler Helicopter Co., Inc. of White Plains, N. Y.

CHARLES KEARNS EDWARDS is retiring from his position as chief engineer to Messrs. Shelvoke & Drewry, Ltd. of Letchworth, Hertsfordshire, England. He will be practising as a consulting automobile engineer at 19, South View, Letchworth, Herts.

MICHAEL H. KLEINMAN, who had been test and development engineer for Chrysler Corp. Engineering Division, Chrysler Corp., Detroit, is now the owner of the Road and Track Custom Engines Co. of Clearwater, Fla.

GLEN E. MEALY has taken the position of field service engineer with Plymouth Motor Corp. of Detroit. He had been service manager for Oestreiher, Inc. of Columbus, Ohio.

DAVID W. PETERSON, former layoutman with Chevrolet Motor Division, General Motors Corp., Detroit, is now an engineer with Hoof Products Co. of Chicago.

STANLEY H. PROFFITT has taken a position in the West Lynn, Mass. branch of General Electric Co. as manager of Controls Subsection. He had worked with the General Engineering Laboratory of the Schenectady branch of GE as supervisor of the Mechanical Controls Unit.

H. JOSEPH CHASE is now manager, jet engine overhaul, Lockheed Aircraft Service, Inc. His new address will be Kawasaki Aircraft Co., Kobe, Japan. He was formerly president of the Bulldog Transport Co., Houston, Texas.

R. J. GIGNAC has been appointed Eastern Division sales manager of Seiberling Rubber Co., Canada, Ltd., Toronto, Ontario. He had served as Montreal branch manager from 1935 until his appointment as Eastern Division sales manager.

SAE

Fathers

and

Sons

ALEX TAUB (M '12) is shown with his son, **EDWARD S. TAUB** (A '54) during the construction of the Taub Engineering Co. laboratory in Washington, D. C. Ed has recently been elected an associate member. He is executive vice-president of Taub Engineering Co. His father, a past SAE Councilor, is president of Taub Engineering.

ROBERT MAYNARD (M '52) points out some details of the Cadillac manufactured tank to his father, **WALTER MAYNARD** (M '27). Bob is now a group leader in the Engineering Department at the Cleveland Tank Plant of the Cadillac Division of General Motors Corp., and plant representative for SAE's Cleveland Section. Walter Maynard joined SAE as a student member in 1916. He is now director of industrial relations, Cleveland Diesel Engine Division of General Motors Corp., and has been an active member of the Cleveland Section since 1927.

C. LEVON EKSERGIAN, executive engineer of the Budd Co., Philadelphia, will be awarded the George R. Henderson Medal by the Franklin Institute of the state of Pennsylvania for his outstanding accomplishments in the field of railway engineering, in particular the development and application of the Disc Brake.

WALTER H. HEGINBOTTOM has joined the Chevrolet Engine & Stamping Plants, General Motors Corp., of Flint, Mich. as quality engineer. He had previously been resident engineer at Rochester Products Division of GMC in Rochester.

DR. HENRY O. FUCHS has resigned his position as chief research engineer of Preco, Inc., Los Angeles and will devote full time to applications and further development of shot peening, flame hardening, and other activities of the Metal Improvement Co., also of Los Angeles.


Fuchs


Frehse

ALBERT W. FREHSE, who had been Vice-president of SAE representing Passenger Car Activity in 1948, is now a consulting engineer in the fields of design, development, and production with offices located in Ft. Myers Beach, Florida. He had formerly been consulting sales engineer with the J. E. Quirk Co. of Detroit.

ROBERT C. MEYER has recently become general service manager of the H. O. Penn Machinery Co. of New York. Previous to this he was a service representative with the Caterpillar Tractor Co. in Peoria, Ill.

THEODORE W. BAYLER, who has been quality control engineer with Kaiser Motors Corp., Engine Division, Detroit, has now taken a position with Continental Motors Corp. in Detroit.

D. S. HARDER, vice-president-manufacturing of Ford Motor Co., received the first annual Presteel award "for his contributions to the field of metal stamping through automation" at the annual convention of the Pressed Metal Institute at Murray Bay, Que. The award was presented by Worcester Pressed Steel Co., which is sponsoring it in co-operation with the institute.

JOSEPH J. DZIEWONSKI has taken the post of production adviser to the general manager of Hindustan Aircraft Ltd., Bengalore, India. Before moving to India, he served as production engineer at the De Havilland Engine Co. Ltd. of Stone Grove, Edgware, Middlesex, England.

GEORGE KALON, who was diesel engine metallurgist with Packard Motor Car Co., Metallurgical Division, Detroit, is now a materials and process engineer with Turbo Products, Inc. of Pacoima, Calif.

EDWARD P. RILEY, who has been serving as manager of the Accessories Division of the Tapco Plant, Thompson Products, Inc. in Cleveland, was named vice president in charge of three of the company's 19 operating divisions: the Accessories and Turbine Drive Divisions at Tapco, and the Commercial Pump Division at the Cleveland Main Plant. **JOHN B. GATES** was named manager of the Commercial Pump Division. He had formerly been manager of the Special Products Division.

JAMES E. ELLIOTT, formerly engineering designer with Boeing Airplane Co., Seattle, Wash., is now a flight test engineer at Consolidated Vultee Aircraft Corp. in San Diego.

ROY T. HURLEY, chairman of the board of Curtiss-Wright Corp., was principal speaker at the banquet honoring the "Man of the Year" as named by the New Jersey Wing of the Air Force Association in recognition of contribution to public understanding of the air age. Mr. Hurley was an earlier recipient of the award.

CHARLES W. SAWHILL is now general sales manager of Aero-Coupling Corp., Burbank, Calif. He was formerly industrial sales manager of that company. Aero-Coupling Corp. is a subsidiary of Aeroquip Corp., Jackson, Mich.


Sawhill


Schultz

PAUL SCHULTZ, who has been sales engineer for the Clark Equipment Co., has been appointed to a general staff position carrying on standardization work in engineering and control procedures for that company.

Correction

ROBERT B. POGUE, has retired as vice president of engineering of the Brake Shoe & Castings Division, American Brake Shoe Co., and has been retained as a consultant for the Division. **ROBERT B. POGUE, JR.**, now assistant manager of equipment sales for American Brakeblok Division of American Brake Shoe Co., Detroit, was sales engineer of that division.

(In the August issue of the Journal, it was erroneously stated: Robert B. Pogue, previously sales engineer for the American Brakeblok Division, American Brake Shoe Co. in Detroit, has been appointed consulting engineer of the Brake Shoe & Castings Division of the company.)

Recipients of Old Timers' Distinguished Service Citations


Black


Johnson


Warner

ROBERT F. BLACK, president, White Motor Co.; **PYKE JOHNSON**, past president, Automotive Safety Foundation; and **JOHN A. C. WARNER**, Secretary and General Manager, SAE, have been awarded Distinguished Service Citations. The awards were made by the Automobile Old Timers at their 15th anniversary dinner held at the Hotel Astor, New York, on October 7.

E. P. WALSH has accepted a position in the Nuclear Propulsion Department, General Electric Co., Cincinnati. He was previously section engineer, Combustion Development Section, Westinghouse Electric Corp., Aviation Gas Turbine Division, Philadelphia.

JOSEPH F. SZEKELY, who had been project engineer of the Ford Motor Co., Aircraft Engine Division, in Chicago, is now working in production engineering at Pratt & Whitney Aircraft, Division of United Aircraft Corp., East Hartford, Conn.

FRED BARBIAN has moved into the sales department of Miehle-Dexter Supercharger Division of Dexter Folder Co., in Racine, Wis. He was previously sales engineer for the Twin Disc Clutch Co., also of Racine.

WILLIAM F. MOORE is now manager, marketing, in the Aircraft Accessory Turbine Department of the General Electric Co. in West Lynn, Mass. He had been manager in the Aviation Pacific Northwest District at Seattle, Wash.

JOHN H. WILKINSON, JR. is now sales engineer for the General Motors Overseas Operations Division, General Motors Corp. of New York. He had formerly held the same post with Detroit Diesel Engine Division, GMC.

HOWARD L. HANSON, 2143 West Blvd., Cleveland, Ohio, has just been discharged from the U. S. Navy and is taking a position in the sales department of North American Refractories Co. of Cleveland.

D. A. BROWN has joined the A. R. A. Mfg. Co. in Fort Worth, Texas as service and installation manager in charge of installations and field engineering. Previously he held the position of service manager with Orand Buick Co. of Dallas.

HARRY O. HILL is now an engineer with Continental Engineering Corp. of Detroit. He had been manager of the Cleveland Branch, American Bosch Corp. of Springfield, Mass.

JOHN ZYTKEWICK is a member of the engineering staff of Ford Motor Co., Dearborn, Mich. He was previously test engineer for Continental Aviation and Engineering Corp., Detroit.

LOUIS P. ZEYTE is now employed at Chevrolet-Central Office, Division of General Motors Corp., in Detroit, as senior body layout. He had been body layout draftsman for Hudson Motor Car Co., Harper Plant, Detroit.

JOHN PATERSON has taken the position of project engineer with the Detroit Diesel Engine Division, General Motors Corp. He had been engineering checker for Harry Ferguson, Inc., also of Detroit.

VICTOR HERON is now director of Limbrey & Heron, Ltd., consulting engineers located in Christchurch, Hampshire, England.

FREDERICK A. SHEN is now working for the Ford Motor Co., Tractor & Implement Division, Birmingham, Mich. He had been design engineer for the Lavers Engineering Co. of Chicago.

C. DONALD LONG is now an associate research officer of the National Research Council, Montreal Road Laboratories, Ottawa, Ontario, Canada. He had been plant manager of Aero Sales Engineering Ltd., also in Ottawa.

Obituaries

ROBERT J. MINSHALL

Robert J. Minshall, (M '42), fifty-six, one of the designers of the B-17 Flying Fortress airplane used in World War II, died Sept. 7 of a cerebral hemorrhage at his home in Shaker Heights, Cleveland. Mr. Minshall was formerly vice-president of Boeing Aircraft Co. of Seattle. He resigned on Aug. 15 as chairman of the advisory board and director of research for Pesco products division of Borg-Warner Corp. of Cleveland.

Minshall, together with J. K. Ball and F. P. Laudan, received the SAE's Wright Brothers Medal for 1936 for their paper "Problems in the Design and Construction of Large Aircraft."

WILLIAM B. LIVINGSTON

William B. Livingston, fifty-six, former sales manager of William J. Ulrich Co., Detroit, died of a heart ailment July 3, in Chicago.

He served twenty-seven years with General Motors Corp., Truck and Coach Division, and one of its forerunners, the Yellow Cab Co. He was assistant to the manager when he resigned from GMC Truck in 1947. He next served with Ford Motor Co., and became president of Metropolitan Motor Coaches in 1949. In 1952 he joined Ulrich.

Livingston joined SAE in 1941 as an associate member.

KARL H. EFFMANN

Karl H. Effmann, age 45, manager of Engineering Division, Perfect Circle Corp., died August 23. His untimely death was due to carbon monoxide from a defective gas refrigerator. The tragedy occurred in a motel at Colorado Springs as the Effmann family was returning from a vacation trip to California. Mrs. Effmann and their three children were near fatalities at the same time, but were successfully revived and are convalescing at their home in Richmond, Indiana.

Effmann was born March 10, 1909, at Akron, Ohio, but moved to Los Angeles with his parents at the age of eight. He attended Los Angeles public schools and graduated from California Institute of Technology with a B.S. degree in 1930.

After graduation Effmann worked briefly for Goodyear and on high tension line construction for one of the West Coast power companies. His first love had always been engines and he shortly got into this line of work as a designer for the Cragar race engine. This work subsequently led him into racing, which was responsible for bringing him to the Middle West and ultimately to his connection with Perfect Circle. He joined Perfect Circle's Engineering group in 1933 and except for one year in sales and another as an engineer in Civil Service, had risen steadily in the organization. He had been head of the Engineering Division since March, 1953.

Effmann became an SAE member in 1938 and served as Chairman of the Indiana Section in 1947.

C. STANLEY SUNDLING

C. Stanley Sundling, 45, of Indianapolis, president of the Laboratory Equipment Co. of Mooresville, Ind. was killed in an automobile crash on August 27th, near Crystal Lake, Ill.

Sundling was a graduate engineer of Toledo University. For a number of years he was associated with the Bowes Seal Fast Corp. of Indianapolis as chief engineer. In September, 1949 he purchased the Laboratory Equipment Co. and was its president at the time of his death.

He was a member of the A. A. A. Contest Board Technical Committee

at the Indianapolis 500 Mile Race for a number of years.

In 1945 he joined SAE and has been active in the Indiana Section. He was a former Reception Chairman.

FREDERICK MYLES HERBERT

Frederick M. Herbert, aviation supervisor, Imperial Oil, Ltd., Vancouver, B. C., Can., died in August. He was sixty.

Herbert has held positions with Imperial Oil, Ltd. for thirty-three years, moving from the sales and service department to the position of aviation supervisor, which he held at the time of his death. Before joining Imperial Oil, he worked with the Maxwell Car Factory and the Studebaker Factory in Detroit, served as machinist at Curtis Aeroplanes, Inc. in Buffalo, and was a pilot in the Royal Air Force.

He was born in Perth, Ont., Can. and was a citizen of Canada. His high school training came in Swan Lake, Man. and he attended technical school in Buffalo.

Herbert became an associate member of SAE in May, 1947.

CARL G. KUSTNER

Carl Kustner, administrative assistant to the general sales manager, Standard Oil Co., Chicago, died on June 2, in Chicago. He was fifty-three.

Kustner was born in New York City, received his B. S. (Mechanical Engineering) from the University of Illinois in 1923, and joined SAE as a full member in April, 1936.

His professional history has been contained within Standard Oil since 1924, except for a year with the U. S. Army, where he served in the Corps. of Engineers at Fort Leonard Wood, Mo. He started as a salesman and turned to engineering in 1927, continuing as an engineer until 1937, when he took the position as head of the Educational & Records Division, Technical Department. From this post, he moved into the position of administrative assistant, which he held at the time of his death.

WILLIAM S. POWELL

William S. Powell, 40, vice president of the Laboratory Equipment Co., Mooresville, Ind., was victim of an automobile crash at Crystal Lake, Ill. on Friday, August 27th.

Powell became a member of SAE in 1941 and was Chairman of the Indiana Section during 1947-1948.

In 1936 he joined the Chevrolet Motor Division, General Motors Corp. and served as production development engineer. Later he was associated with the Merz Engineering Co., at Indianapolis, attaining the position of chief engineer. In 1944 he joined Laboratory Equipment Co., of which he was vice president at the time of his death.

He was appointed Chairman of the Technical Committee for the Indianapolis 500 Mile Race in 1949. His work with the races was of exacting and highly technical nature. Recently, he submitted designs to the Indianapolis Motor Speedway management for a timing and scoring mechanism.

He is survived by his wife, Mrs. Waltrude Powell, and daughter Penny, 8.

WILLIAM W. BARRY

William W. Barry, seventy-five, of 9339 North Ridgeway, Skokie, Ill., died at his home Sept. 7 after a five months illness. He was an associate member of SAE twenty-six years.

Barry started his career in industry as a sales representative with Croname, Inc. or Crowe Name Plate & Manufacturing Co., as it was known then. He continued his service to that company for thirty-five years, rising to the position of vice-president which he held at the time of his retirement in 1945.

After his retirement Barry was active in many civic activities. For example, he was a member of the International Association of Fire Chiefs, the National Fire Protection Association, the local Chamber of Commerce and Lions Club, and the local Republican Club.

E. J. TOMPKINS

E. J. Tompkins, sixty-two, metallurgical engineer, Central Steel & Wire Co. of Chicago, died in August. He had joined SAE in 1945 as associate member and obtained full membership in October, 1951.

Tompkins started out in 1916 as a metallurgist with Illinois Steel Co., Gary, Ind. In 1921 he moved to the Armored Tire & Rubber Co. as engineer. Later he became sales engineer for La Salle Steel Co. of Hammond, Ind. It was in 1934 that he joined Central Steel & Wire.

Born in Lake City, Iowa, he attended public schools there and then took courses at Iowa State University in 1909. He obtained an M.E. at the University of Illinois in 1914.

As a member of SAE, Tompkins has served as Vice-Chairman, Chicago Section Materials & Production Activity.

MAJOR U. S. AMIN

Major U. S. Amin, Superintendent of Police, in charge of the Motor Transport Division, Government of Bombay, Greater Bombay Police, Bombay, India, died February 2. He was fifty-three.

For six years beginning in 1943, Major Amin served as Commandant and Instructor in the Automotive Army School of the Indian Army and was chief engineer in the Army Workshops of the State of Baroda before becoming Superintendent of Police in Bombay.

February, 1951, he joined SAE as a foreign member. He was born in Baroda and was a citizen of India.

BENJAMIN R. CHASE

Benjamin R. Chase, sixty-four, superintendent of transportation with General Ice Cream Corp. of Cambridge, Mass., and associate member of SAE since 1949, died August 24.

After serving in the army in 1917 and 1918, Chase operated his own garage for eleven years. He then joined the General Ice Cream Corp. as a garage superintendent and had been employed with GIC twenty-five years at the time of his death.

He was born in Amsterdam, N. Y., attended Amsterdam public schools, and took special courses at Cornell University.

H. IRVING GLASHOFF

H. Irving Glashoff, (A '36), lubrication engineer connected with American Oil Co., Technical Service Department, Baltimore, Maryland, for twenty years, died August 17 after a lengthy illness.

Glashoff had served in the Philadelphia, Baltimore, Washington, and Jacksonville Divisions of American Oil. Previous to this he had been employed as assistant foreman at Motor Car Service Co., had been partner of the Parsons & Glashoff Co., sales and service, automobile accessories and maintenance, and had served as salesman for Funk & Ennis of Baltimore.

He was born in Baltimore in 1897 and attended public schools there.

EDWARD WELLS BEACH

Edward Wells Beach, eighty-one, died June 27 in Hartford Hospital after a two-week illness. He had been in retirement since April, 1950.

Mr. Beach was the founder of the Old Manufacturers Foundry Co. of Waterbury and was its general manager until 1918. Then he moved to Cleveland where he served as president and general manager of the Ferro Foundry & Machine Co. He was later president and general manager of the Warren Foundry Co., in Warren, Ohio until 1927, when he joined the Campbell, Wyant, & Cannon Foundry Co. He was an engineering executive of this company at the time of his retirement.

Beach became a member of SAE in 1910.

Students Enter Industry

JOHN C. WALKER (Michigan State College '54) has joined the Chrysler Corp. of Detroit as a member of the engineering division.

KENNETH H. WHITE (California State Polytechnic College '54) is a test engineer in the General Electric Plant at Erie, Pa.

RICHARD J. WITTEMAN (Loyola University '54) has joined the Western Gear Works of Lynwood, Calif. as an engineering trainee.

JOSEPH WISKIRCHEN (Parks College of Aeronautical Technology '54) has joined McDonnell Aircraft Corp. in St. Louis as engineer.

LOWELL T. LUMLEY (University of Cincinnati '54) has taken a position as a field serviceman with the Cincinnati Milling Machine Co.

HENRY K. PURNHAGEN (Missouri School of Mining and Metallurgy '54) is now a detail engineer of the Allison Division of General Motors Corp. located in Indianapolis.

JAMES F. DUFFIN (University of Utah '54) is now a research engineer of the Shell Oil Co. in Martinez, Calif.

JAMES E. BELDEN (Northrop Aeronautical Institute '53) is now with North American Aviation, Inc. in Los Angeles as junior engineer, structures.

JACK BEECH (College of the City of New York '54) is in Farmingdale, L. I. working as a designer with Republic Aircraft Corp.

OSBORNE J. FAGAN (Northrop Aeronautical Institute '53) is working as an engineering draftsman with Manning, Maxwell, & Moore, Inc., Aircraft Products Division, in Inglewood, Calif.

JOHN P. KULY (Michigan State '54) is a manufacturing supervisory trainee of the Continental Can Co. in Milwaukee.

WAYNE A. HAHNE (Missouri School of Mining and Metallurgy '52) is participating in the college training program at the Central Foundry Division of General Motors Corp. in Danville, Pa.

BERNARD HARKINS (Syracuse University '54) is a junior engineer for the Mather Spring Co. of Linden, N. J.

ROBERT RAY WIGHTMAN (Michigan State Collge '54) is with North American Aviation, Inc., Chatsworth, Calif. as a junior engineer.

WILFORD E. MAPLES (General Motors Institute '52) has taken a position with the Detroit Transmission Division of General Motors Corp.

RAYMOND G. FISCHER (Tri-State College '54) has joined the National Automatic Tool Co. of Richmond, as a development engineer.

ALBERT M. MIKOLAJCZYK (Tri-State College '54) is with the General Electric Co. in Fort Wayne, Ind. as a planning and wage rate trainee.

EMIL SUCHY (Ohio State University '54) is employed in a supervisory capacity in the production engineering department of the Cummins Engine Co. in Columbus, Ind.

WILLIAM E. ORAM (General Motors Institute '54) is now a junior layoutman in Chevrolet Motor Division, Central-Office, General Motors Corp. in Detroit.

HAROLD H. MACKLIN, JR. (North Carolina State College of Agriculture and Engineering '54) is a research engineer with Ford Motor Co., Dearborn, Mich.

GEORGE T. REAVIS (Purdue) is now a laboratory technician with Allison Division, General Motors Corp., in Indianapolis.

JULIAN BERCH (New York University College of Engineering '52) has taken the position of hydraulic engineer with Republic Aviation Corp. of Farmingdale, L. I.

RICHARD A. HOFFMAN (Rensselaer Polytechnic Institute '54) is now a member of the Petroleum Laboratory, Chamber Works branch of E. I. Du Pont de Nemours & Co. of Deep Water, N. J.

RICHARD ROMAN (Purdue University '54) is now an engineer junior grade working with Municipal Electric Light and Power Plant, Richmond, Ind.

CHARLES R. WILLIAMS (Purdue University '54) has joined the Worthington Corp., Harrison, N. J. as a member of the training program.

CONRAD TEICHERT, JR. (General Motors Institute '53) has joined the Process Development Department, Diesel Equipment Division, General Motors Corp. of Grand Rapids, Mich. as a junior designer.

VIRGIL J. PALUB (Colorado University '54) has joined the Hughes Aircraft Co., Tucson, Ariz. as a manufacturing engineer.

ROBERT VINCENT ADAMS (Purdue '54) has taken a position in Bendix Aviation Corp., South Bend, Ind. as a junior engineer, fuel metering.

from the Sections

Twin City

Field Editor
R. V. Rosenwald
Sept. 8

"MINNETONKA"—THE NORTHERN PACIFIC'S FIRST LOCOMOTIVE was inspected and compared with later models such as the latest 3-unit 4500 hp diesel passenger locomotive, during the tour taken in this opening meeting. The tour gave first-hand evidence of what 84 years of progress has done to motive power. After the trip through the Northern Pacific Railway Co.'s Mississippi Street diesel repair shops, Mr. Ernstrom, general mechanical superintendent, presented an interesting summary of the tour along with additional comments and highlights about the Northern Pacific Railway.

Northwest

Field Editor
S. J. McTaggart
Aug. 12

50% REDUCTION OF PASSENGER AIR TRIP TIME is possible without increasing flying speed one mile per hour, as pointed out by SAE President William Littlewood. Improvements in ground transportation, ticket reservations, baggage handling, and conveyor type loading ramps will save the air passenger countless hours of delay.

Inasmuch as his address was spontaneous, stemming from his terrific memory and notes scribbled on small bits of paper carried in many pockets, he touched on many phases of aviation, humor and philosophy. One point he rammed home to the young men of SAE was the importance of taking an active part in SAE, giving papers and standing up and being heard. SAE, related industry, and the young men themselves will benefit mutually from the injection of new ideas and enthusiasm.

Discussion brought out some interesting facts concerning jet powered transport aircraft:

1. Traffic control will have to be synchronized to eliminate stacking of incoming aircraft because of the high fuel consumption rate of jet engines.
2. Jet engine noise will have to be reduced to pacify the inhabitants of areas adjacent to airports.
3. The initial cost of jet aircraft is very high at the present time.
4. Adequate safeguards will be necessary to prevent the rupture of the pressurized cabin because of jet operational altitudes of from 35,000 feet to 50,000 feet. A rupture would result in instantaneous explosive decompression.

Field Editor
S. J. McTaggart
Sept. 10

INCREASED FUEL MILEAGES HAVE BEEN REPORTED by many operators after converting their Cummins diesel engines to the new PT fuel system. Smoke is said to be reduced. Less failures due to dirt in the system have occurred. These facts arose out of the discussion period following the presentation, by H. J. Ginther, of the J. W. Rowell and C. R. Boll paper entitled "The New Cummins PT Diesel Fuel System."

The PT fuel system consists of the fuel pump (with governor), the supply and drain lines, and the injectors.

President Littlewood Visits Hawaii

President and Mrs. William Littlewood

Hawaii

Hawaii greeted SAE President William Littlewood and his wife with the typical "Aloha" Monday, Sept. 13 as the S.S. Lurline neared the harbor at Honolulu. A group of members boarded the ship off the harbor and more were on hand to greet the arrivals as the ship docked.

Nearly one hundred members turned out to meet Littlewood and to hear him speak at the Honolulu meeting, Sept. 20 at Civilian Employes' Association headquarters, International Airport. There were many automotive men and airline maintenance people present, also a good many men from various branches of the military.

The Littlewoods were taken on several shopping and sight-seeing tours, one of which was a very interesting trip around the U. S. Navy's Pearl Harbor. They also enjoyed a lovely, informal buffet at the home of Mr. and Mrs. Clyde Ahef.

Hawaii Section Chairman C. R. McClellan accompanied the Littlewoods to the Island of Maui, where Littlewood addressed another group of SAE men and their guests. Soon after, another interesting meeting took place in Hilo with the very active Hilo members. Approximately 40 members were in attendance

Greeting President and Mrs. Littlewood on the dock after they disembarked from the S. S. Lurline at Honolulu are Section members and their wives.

Officers of the Hawaii Division at Hilo appear at the right with visiting President Littlewood (center). They are (left to right) Ed Watt, Robert McGill, Don Gedge and W. W. Miller.

and several members from Honolulu flew over to Hilo to attend the meeting. Littlewood spoke on engineering problems which lie ahead in the aircraft industry, taking as his subject, "How Do We Fly From Here?"

Although SAE does not hold meetings on the Island of Kauai, the Littlewoods attended festivities on the island and met with many people there.

During the three week visit, Littlewood made many interesting statements concerning jet transports in general. To start with, he believes that the day of commercial jet transportation in the United States is "at least five years away, and maybe more."

Hawaii members were deeply honored to have Mr. and Mrs. Littlewood visit the islands and address the meetings. They look forward to more presidential visits.

—Reported by Robert Linder, Publicity Chairman

Salt Lake

Field Editor
C. W. Dunbar
Sept. 13

MORE COMPACT, LIGHTER WEIGHT DIESEL ENGINES will be made possible in the future by the higher rotative speeds allowed by the new PT (Pressure-Time) Fuel System recently developed by the Cummins Engine Co., Inc. This development was indicated by L. E. Williams in his discussion of the new PT Fuel System before the initial fall meeting.

Addressing the audience of more than 100, Williams, regional manager for Cummins, described the operation of the new system, its advantages and its impact upon future utilization of diesel engines. The advantages of the PT system are greatly **reduced bulk and weight** (PT pump weighs 13% of distributor-type fuel pump), **decreased number of parts** (182 rather than 415 in disc-type pump) and **applicability** to engines with rotative speeds greater than 4000 rpm as demonstrated by research tests.

Hawaii

Field Editor
F. L. Helbush
July 19

HAWAII'S FIRST 6-LANE HIGHWAY is under construction, being built to the highest standards of road construction found in Hawaii, according to Alwyn G. Hansen, manager of the Tractor & Implement Department, Theo. H. Davies, Ltd., who represent Caterpillar. It would take $50,000,000 or roughly ten times Hawaii's annual highway budget to bring all parts of Hawaii's Federal Aid System to minimum standards required by today's motor vehicle travel. Millions of tons of earth must be moved and track type tractors and prime movers are essential to do the job.

Atlanta Group Sept. 13

From Section Cameras

Outlining The Oil Requirements of today's high h.p. engines is Hugh Hemingway, sales-service general manager of Pure Oil Co. and member of the SAE Fuels and Lubricants Technical Committee.

Receiving The SAE Past Chairman's Certificate from Jack S. Reid (standing right), 1954–55 Chairman, is Jack T. Layfield, Jr., 1953–54 Chairman.

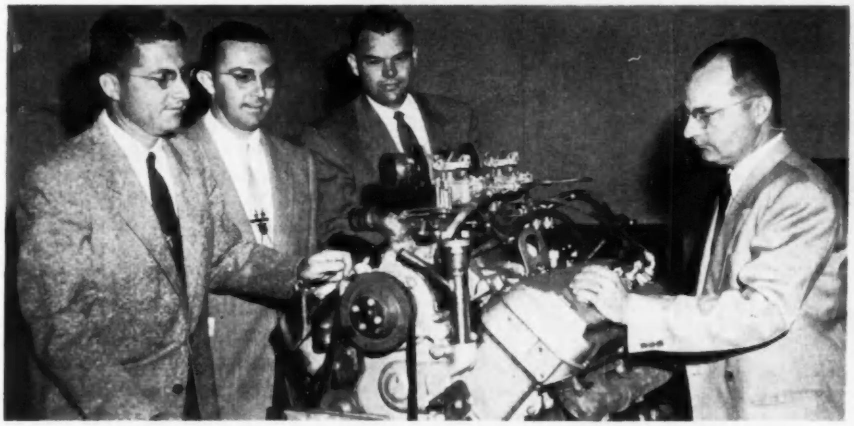
Northwest Aug. 12

Visiting SAE President William Littlewood is shown in the company of (left to right) Bill McClure, Section Secretary; A. D. McLean, Vice-Chairman; and Robert Norrie, Past Chairman.

Northwest Sept. 10

Introducing Harry J. Ginther, who presented the paper "The New Cummins PT Fuel System," is Section Chairman Ed Johnston. On the right are shown several members of the Section inspecting the new PT pump.

Northern California—South Bay Division



SAE South Bay Division Has Been Formed. Inspecting a 'souped-up' engine are members of the newly formed South Bay Area Division of SAE, which held its first meeting Oct. 5. Left to right are W. J. Adams, Jr., Chairman of the Division; Frank L. Jarrett, Program Chairman; Jack V. Harris, Treasurer; and Forrest W. Fingerle, Membership Chairman.

Chicago Sept. 20

Announcing The Appointment of T. H. Thomas as South Bend Division Chairman is Chicago Section Chairman, M. P. de Blumenthal (standing). Seated left to right are Harold Hanlin, Clark Equipment Co.; J. A. MacLean, Bendix Aviation; J. R. Gillette, Lincoln and Mercury Car Engineering; V. H. Hoehn, U. S. Rubber; T. H. Thomas, Bendix Aviation; J. A. Nelson, Standard Oil; and D. M. Firth, Dodge Mfg. Co.

From Section Cameras

Central Illinois Sept. 27

Introducing The Speaker, J. R. Gillette (right), of Lincoln and Mercury Car Engineering is W. M. Owen, Technical Chairman of the meeting. Gillette described the Mexican Pan-American Road Race.

Chicago Sept. 10

Celebrating the Eleventh Annual Playday at Olympia Fields Country Club are members of the Entertainment Committee headed by W. L. Rodgers and Ed Hendrickson. Section Chairman M. P. de Blumenthal is shown at the microphone.

Six Former Chairmen of the Cleveland Section served as pallbearers at the funeral of W. S. "Walt" Howard, July 29. They are left to right: Robert Cass (1947-48) and President of SAE (1953-54), E. K. "Ned" Brown (1953–54), Virgil Speece (1950–51), Robert I. Potter (1951–52), Charles H. Miller (1942–43), and Robert F. Steeneck (1949-50).

Texas

Field Editor
Harold Anderson
Sept. 17

THREE "MUSTS" FOR ALL-OUT AUTOMOBILE AIR CONDITIONING in the future were listed as follows by J. W. Duhn, of Chrysler:

1. Reduction in price
2. Smaller and lighter units
3. Abolishment or removal of the belt line.

These are necessary to reach the two main goals; namely, the need for large capacity cooling and for a large air movement in the vehicle.

Ernest Mailloux, Past Chairman, was presented with a plaque for his good work during the past year.

Reported by Art Johnson, Secretary

Detroit

Field Editor
W. F. Sherman
October 4

EXCESS POWER AND UNUSUALLY HIGH ROAD PERFORMANCE has been predicted of the small light weight Firebird developed to carry the gas turbine, according to G. T. Christiansen, staff assistant to the director of styling, General Motors Corp. This prediction came in the presentation of the paper "Pinwheels or Pistons?" by its authors, Ralph A. Richardson, G. T. Christiansen, Robert Schilling, and W. A. Turunen. The combination of body, chassis, and power plant discussions was termed by Richardson as "a progress report on a research project not yet completed—aimed at obtaining basic information—installed in a bus and a high-performance single-seat vehicle to get that information."

Opening the meeting, Harry E. Chesebrough, Chairman, acted in behalf of the SAE Council in presenting the first annual Russell S. Springer Award to Fred C. Matthaei, Jr., of American Metal Products Co., as the youngest sole author of a technical paper published in the 1954 "Transactions." The paper, "Universal Positioning Seat Track," was cited as a paper of "high reference value and distinguished merit."

San Diego

Field Editor
M. E. Morrison, Jr.
Sept. 2

THE $7,000, 270 CU IN. MEYER-DRAKE ENGINE equipped the 33 qualifying cars of the 1954 Memorial Day Indianapolis race. Interesting facts noted by Lou Meyer about this engine were that it (1) burned alcohol and methanol for fuel, (2) got four miles per gallon of fuel, (3) has a 14 :1 compression ratio, (4) develops 330 hp at 5000 rpm, (5) develops top torque at 4200 rpm, (6) turned up to 6400 rpm during the race.

Fred Offenhauser presented a brief history of the development of the 270 and the film "Indianapolis Hotfoot" depicted its resulting capabilities. George Salih, driver and technician for Meyer-Drake, discussed the new 180 cu in. displacement engine now being developed with a supercharger.

Buffalo

Field Editor
D. I. Hall
Sept. 21

"TAPPING" OF AN OPEN HEARTH FURNACE was a special feature of the tour through the Buffalo District Plant of the Republic Steel Corp. Other features included a blast furnace, open hearth, blooming mill, and bar mill operations. A film, "Steel Frontiers," was shown prior to dinner and the tour.

Milwaukee

Field Editor
F. B. Esty
October 1

PICTURE AND SLIDE PREVIEWS of the many interesting developments now under field test by Thompson Products were presented by Ted Thoren, director of engineering at Thompson. Some of these developments are sealed hydraulic tappers, self-adjusting mechanical tappers, cost reducing valve rotators, steel piston rings which need no surface treatment, and extruded aluminum pistons.

Northern California

Field Editor
R. E. Van Sickle
Sept. 22

THE GAS TURBINE'S FUTURE FOR POWERING AUTOMOBILES, TRUCKS OR BUSES depends on developments still in their early stages according to W. A. Turunen, head of Gas Turbines Department, General Motors Research Laboratories. Speaking at the Section's Transportation and Maintenance meeting, Turunen said that such problems as fuel economy, delayed acceleration and lack of engine braking must be solved if turbines are to replace piston engines in the nation's motor vehicles.

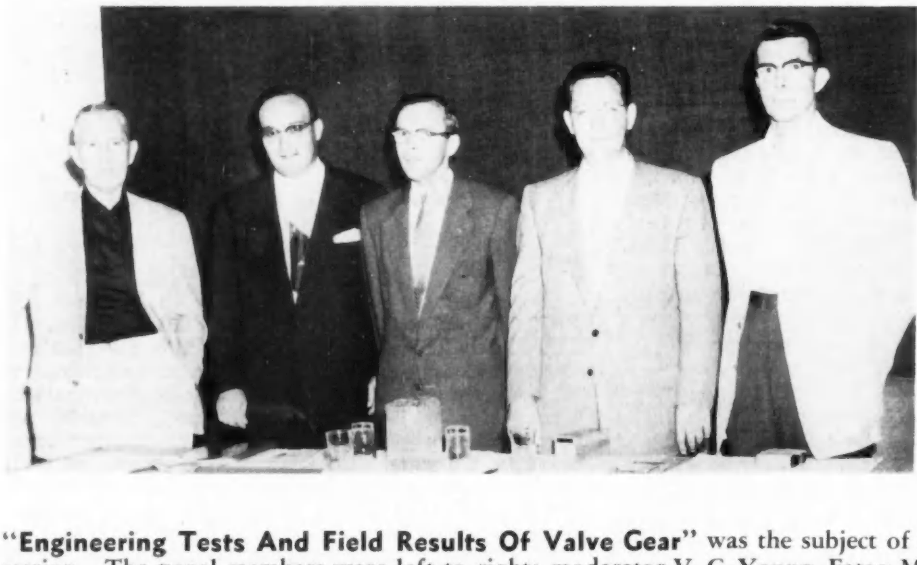
On the other hand, road test experience with the XP-21 Firebird and the GM Turbocruiser, first turbine automobile and bus in the United States, proved some problems less bothersome than anticipated.

From Section Cameras

Detroit

At Detroit Section's Summer Meeting this year attendance was high, technical sessions fruitful, and enjoyment general. Again it was held at The Greenbriar, White Sulphur Springs, West Va. The dates: Sept. 9–11.

Discussing the Friday, Sept. 9 session subject, "Functional Beauty in the Sports Car," are left to right Chairman K. E. Coppock, speaker Virgil Exner of General Motors, and Vice-Chairman H. E. Chesebrough.



"Engineering Tests And Field Results Of Valve Gear" was the subject of the Saturday, Sept. 10 session. The panel members were left to right: moderator V. C. Young, Eaton Mfg. Co.; F. A. Veraldi, Ford; E. G. Moeller, Chrysler; J. B. Bidwell, General Motors; R. V. Kerley, Ethyl Corp.; and, in the picture on the right, John Newton, Thompson Products.

Among these were high operating temperature, air consumption, large quantities of exhaust gas, engine controls, noise levels, durability, maintenance and starting.

Turunen cited as gas turbine advantages: a favorable weight-to-power ratio, ability to produce maximum torque at stall, and ability to operate on relatively low grade fuels. These advantages can best be exploited in commercial or heavy duty applications. So, the gas turbine may appear first in these types of vehicles.

Atlanta

Field Editor
D. J. Tolan
Sept. 13

CURRENT COMPOUNDED 5W-20 AND 10W-30 OILS have been shown to provide protection against abrupt changes in weather. The development of these oils is the result of an intensive search for lubricants to meet the challenge of today's high horsepower engines. Hugh Hemingway, Sales-Service general manager of the Pure Oil Co. and member of the SAE Fuels and Lubricants Technical Committee, brought out these facts in his talk in Atlanta.

St. Louis

Field Editor
Gene Kropf
Sept. 22

"HOW GOOD BEER IS ENGINEERED" was the subject of the opening fall meeting in St. Louis, illustrated by a plant tour of the world famous Anheuser-Busch Brewery and two films tracing the brewery's history. The session combined a technical meeting with a social gathering that drew an attendance of 116 members, wives, and guests. A refreshment hour in the rathskeller, complete with a two-piece German band, completed the evening.

Texas Gulf Coast

Field Editor
G. W. Putney
Sept. 10

A WORTHWHILE CUSHION OF LOADING FLEXIBILITY can be obtained by using tandem axles even when no increase in gross train weight can be obtained. But **there is no fixed formula or rule** which can be applied in determining whether or not to use tandem axle equipped power units in preference to single axle vehicles, according to E. E. Siegrist, manager of Timken-Detroit Axle Division, Rockwell Spring and Axle Co. He pointed out that tandem axles and dual tires were first considered around 1918 when single pneumatic tires had reached the practical limits of capacity of that era.

Mid-Continent

Field Editor
L. D. Reis
Sept. 17

THE NEW BOEING 707 JET TRANSPORT will usher in a new era in air transportation, military and commercial, according to Maynard L. Pennell, chief project engineer—Aircraft, Boeing Aircraft Corp. Safety and economy are achievable goals for a Jet Transport. The Boeing 707 will prove to be outstanding in **performance, economy, and safety.**

Central Illinois

Field Editors
Y. M. Miller
E. Hanson
Sept. 27

ALTITUDE VARIATIONS FROM SEA LEVEL TO 10,000 FEET AND AROUND 6000 CURVES typify "the toughest auto race in the world," the Mexican Pan-American Road Race. Joseph R. Gillette, recently promoted to supervisor, Advanced Car Planning Section, Lincoln and Mercury Car Engineering Planning and Programming Department of the Ford Motor Co., gave this description. Results show that only one-third of the contestants complete the 1912 mile, five day grind from Tuxtla, the southern starting point, to Juarez on the Rio Grande.

The Lincoln team considers advanced preparations and planning important for successful completion of the race. Rotating parts are magnafluxed and critical castings checked for porosity. Maintenance crew members are selected and assigned duties on the area of the car on which they are experts. Prior to the race, pilots and copilots traveled 8000 miles charting information on the condition of the road.

Of the 1954 races to be held in November, Gillette said:

1. There will be five classes of cars instead of four, the addition being European stock cars of 2000 cc displacement.
2. After their first start, cars will be started in the same order that they finished the previous lap. This mixing of classes should increase the spectator's interest in the race.
3. Brakes cannot be cooled with blowers or air scoops this year.
4. Maintenance time is reduced from three hours to one except in Mexico City where an extra hour will be allowed to cross the city.

From Section Cameras

Williamsport Group

The Governing Board of the Williamsport Group are shown as follows: First Row—Ewing W. Mueseler, Vice-Chairman; Bernard L. Sharon, Field Editor; Fred G. Rohm, Past Chairman; William Ribando, Chairman; and Wendell G. Evans, Reception Chairman. Second Row—Blair S. Kratzer, Secretary; Robert B. Ingram, Membership Chairman; Allen Weiss, Treasurer. Third Row—Frank W. Riddell, Publicity and Placement Chairman; Paul Cervinsky, Program Chairman.

Northern California Sept. 22

Speaker Of The evening was W. A. Turunen (left), head of Gas Turbines Department of General Motors Research Laboratories. He spoke on the "Gas Turbine as a Vehicle Engine." On the right is J. R. Mac Gregor, Chairman of the Section.

Twin City Sept. 8

On Tour of Northern Pacific's diesel repair shops are Twin City Section members. Bruce Hoesly, mechanical engineer for Northern Pacific and member of the Section, is shown during demonstration.

TECHNICAL COMMITTEE *Progress*

Revised Standard for Refrigeration Flare-Type Fittings

A STANDARD on Refrigeration Flare-Type Fittings has been approved by the American Standards Association. It has been designated American Standard B70.1-1954. This Standard was developed by the SAE Tube, Pipe, Hose, and Lubrication Fittings Committee, which was augmented to include members of subcommittee 11 of ASA B16. It was submitted to the ASA under the Existing Standards Method. At the request of the Society, the ASA granted the SAE proprietary sponsorship of the Standard, which makes the SAE responsible for keeping it up to date.

The new Standard was developed from the existing SAE Standard on Refrigeration Fittings, which was expanded and revised to conform to the latest practices before it was submitted as an American Standard.

Thus, the new version covers the same basic fittings as the old SAE Standard, but it does so in a much more complete manner. The earlier standard merely gave the dimensions for the basic fittings, without actually spelling out the many possible reducing combinations. This meant that the user generally had to figure out for himself the dimensions for the combinations he needed. The new version, on the other hand, gives detailed drawings, dimensions, and tolerances for more than 30 combinations of reducing fittings of each configuration, as well as such accessory parts as gaskets, bonnets, and plugs. Solder cups are included and also capillary tube fittings for two tube sizes.

In addition, the new Standard covers the following items:

1. Pressure ratings and service limitations.
2. Abbreviations for end connections.
3. Sizes, and methods of designating openings of reducing fittings.
4. Material specifications.

J. E. Gray, chairman of the Refrigeration Fittings Subcommittee of the SAE Tube, Pipe, Hose, and Lubrication Fittings Committee, which developed the new American Standard on Refrigeration Flare-Type Fittings

Historical

Automotive tube fittings were first standardized by the SAE in 1912. It was soon found that the refrigeration industry was also making use of them, for the automotive fittings were considered suitable for refrigeration applications except that they were cast of a relatively porous material. Although the refrigeration industry does not work with high pressures, nonporous metal must be used for refrigeration fittings to provide the proper seal.

As time passed, small differences began to occur between the refrigeration and the automotive fittings. Finally this growing apart reached the point where it became necessary to set up a section in the standard that would specifically cover refrigeration fittings.

Meanwhile, several marine companies asked the SAE to develop fittings for their use.

Since the problem here was the same as that for the refrigeration applications, that is, pressures were low but the seal had to be positive, it soon became apparent that the marine industry would use the same fitting standards that were developed for refrigeration use. Therefore, the new section of the standard was headed, "Refrigeration and Marine Type." It was adopted in 1936.

It was the 1953 revision of this 1936 SAE Standard that was expanded and revised by the SAE TPHLF Committee for submission to the ASA. This latest revision of the SAE Standard continues to state that it is applicable to both refrigeration and marine fittings. However, it was submitted to the ASA only as a refrigeration fittings standard.

G. A. Rea, Heil Co., is chairman of the SAE Tube, Pipe, Hose, and Lubrication Fittings Committee and J. E. Gray, Mueller Brass Co., is chairman of the Refrigeration Fittings Subcommittee, which did the actual work of developing the new version of the standard.

Other members of the subcommittee are: F. R. Allen, York Corp.; G. R. Allen, Superior Valve & Fittings Co.; C. H. Barrows, Anderson Barrows Metal Corp.; L. W. Benoit, Manufacturers Standardization Society of the Valve & Fittings Industry; B. V. Blazer, Passaic, N. J.; G. E. Franck, Imperial Brass Mfg. Co.; J. L. Hall, Nashua, N. H.; A. I. Heim, Copper & Brass Research Association; R. F. Holmes, AC Spark-Plug Division, GMC; W. P. Kliment, Crane Co.; K. Newcum, Remco, Inc.; R. W. Phillips, Weatherhead Co.; A. D. Sullivan, Brunner Mfg. Co.; A. N. T. St. John, Resistoflex Corp.; and C. A. Witt, Kerotest Mfg. Co.

Copies of the Standard can be obtained from the SAE Special Publications Department as SP-95 Refrigeration Flare-Type Fittings. Price: $1 to members, $2 to nonmembers. Quantity prices available on request.

High-Altitude Plane Cabins Must Cater to Passenger

IN designing aircraft for flight above 25,000 ft altitude, cabin ventilation, temperature, humidity, pressure and oxygen become vital considerations for the safety and comfort of passengers. SAE Committee on Aircraft Air Conditioning Equipment has been investigating the experience of manu-

Continued on page 102

First Springer Award Winner

F. C. Matthaei, Jr. (left), is presented with a certificate by SAE Detroit Section Chairman H. E. Chesebrough at the Section's October 4th meeting. Reason: Matthaei was first winner of SAE's Russell S. Springer Award

FREDERICK C. Matthaei, Jr., sales engineer of the American Metal Products Co., is the first recipient of the Russell S. Springer Award. For being the youngest SAE member whose paper has been published in SAE Transactions, Matthaei received an honorarium of $100 plus a certificate.

The Award was given to Matthaei on the publication of his paper, "Universal Positioning Seat Track," in the 1954 SAE Transactions. The paper was presented at the SAE Annual Meeting, Jan. 11, 1954. The Award was presented to Matthaei at the October 4 meeting of the Detroit Section.

The Springer Award, established by SAE Council this year, grew out of a $5000 bequest to the Society by the late Russell S. Springer. (For details on criteria for the Award, see SAE Journal, July, 1954, page 84.)

YOU'LL ... be interested to know that ...

Recently added appointments to the 1954 Transportation & Maintenance Activity Committee are Carl T. Doman of Ford and J. O. Sibley of U.S. Fidelity & Guaranty Co.

REAPPOINTED as SAE-NOMINATED CRC DIRECTORS for two-year terms starting Jan. 1, 1955 are L. L. Bower, W. G. Lundquist, and E. S. MacPherson. Their previous two-year terms will be completed at the end of 1954. Other SAE-nominated members of the Coordinating Research Council board of directors are E. N. Cole, G. J. Huedner, Jr., R. D. Kelley, and Arthur Nutt, whose two-year terms end December 31, 1955.

M. Gould Beard of American Airlines has been named SAE representative on the Guggenheim Medal Board of Award for a term ending September 30, 1955. Other SAE members of this Board are R. P. Kroon of Westinghouse Electric, and E. C. Wells of Boeing.

SAE NATIONAL MEETINGS...

November 4-5, 1954
National Fuels and Lubricants Meeting
The Mayo, Tulsa, Okla.

January 10-14, 1955
Golden Anniversary
Annual Meeting and Engineering Display
The Sheraton-Cadillac Hotel and Hotel Statler, Detroit, Mich.

March 1-3, 1955
Golden Anniversary
Passenger Car, Body and Materials Meeting
The Sheraton-Cadillac Hotel, Detroit, Mich.

March 14-16, 1955
Golden Anniversary
Production Meeting and Forum
Netherland Plaza, Cincinnati, Ohio

April 18-21, 1955
Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York, N. Y.

June 12-17, 1955
Golden Anniversary
Summer Meeting
Chalfonte-Haddon Hall, Atlantic City, N. J.

August 15-17, 1955
Golden Anniversary
West Coast Meeting
Hotel Multnomah, Portland, Ore.

September 12-15, 1955
Golden Anniversary
Tractor Meeting and Production Forum
Hotel Schroeder, Milwaukee, Wis.

October 11-15, 1955
Golden Anniversary
Aeronautic Meeting
Aircraft Production Forum, and Aircraft Engineering Display
Hotel Statler, Los Angeles, Calif.

October 31-November 2, 1955
Golden Anniversary
Transportation Meeting
The Chase, St. Louis, Mo.

November 2-4, 1955
Golden Anniversary
Diesel Engine Meeting
The Chase, St. Louis, Mo.

SAE Section Meetings . .

Baltimore—Dec. 9

How Do We Fly From Here?—1954 SAE President, William Littlewood.

Buffalo—Nov. 16 and 23

Sheraton Hotel, Buffalo. Dinner 6:30 p. m. Past Highlights & Future Developments In Automotive Engr.—A. T. Colwell, Thompson Products, Inc., Clev., Ohio.

Nov. 23—Rochester Division. Practical Gear Design Practice. The Proper Gear In the Right Place, Plant tour, Gleason Mfg. Co., Rochester, N. Y.

Canadian—Nov. 17

Royal York Hotel, Toronto. Dinner 7:00 p. m. Cored Forgings & Pressings—W. H. Irwin, mgr. Foundry Div. Canada Metal Co., Ltd., Toronto.

Central Illinois—Nov. 22

American Legion Hall, Peoria, Ill. Dinner 6:30 p. m., meeting 7:45 p. m. Recent Developments in Tire Technology—Representative of Goodyear Tire & Rubber Co., Akron, Ohio.

Chicago, South Bend Division—Nov. 15

Hotel La Salle, Bronzewood Room, South Bend, Ind. Fork Trucks—Design, Application and Operation—Glen R. Johnson, prod. sales mgr., Clark Equipt. Co., Buchanan, Mich. Technical Chairman for the meeting will be Mr. Earl M. Douglas, vice-president in charge of mfg., Studebaker Corp., South Bend, Ind.

Cincinnati—Nov. 22

Engineering Society of Cincinnati, Cinn., Ohio. Dinner 6:30 p. m., meeting 8:00 p. m. Walter Klayer, Aluminum Indust., Cinn., Ohio.

Dayton—Nov. 23

How Do We Fly From Here?—1954 SAE President, William Littlewood.

Detroit—Nov. 15 and 29

Rackham Educational Memorial. Dinner 6:30 p. m., meeting 8:00 p. m. Space Flight. Wernher von Braun, Chief, Guided Missile Dev. Div. Redstone Arsenal, Huntsville, Ala. Dinner speaker—Al Thomas—Behind the Iron Curtain in Professional Wrestling. Meeting open to SAE members and applicants only.

Nov. 29—Rackham Educational Memorial. Meeting 8:00 p. m. Panel meeting on The A B C's of Suspension Systems—Nick Baracos, Mercury Div., Ford Motor Co., Philip Bowser, Chev. Motor Div., GMC, Robert B. Batchelor. Chrysler Corp.

Metropolitan—Nov. 18

Engineering Societies Building, N. Y. City. Meeting 7:45 p. m. The Gasoline Can Make a Difference—H. J. Grance—W. A. Howe—Gulf Oil Corp.

Mid-Continent—Nov. 17

Oklahoma A & M College, Student Union Bldg., Stillwater, Okla. Looking Ahead from Detroit—Paul Richard, Auto. Engr., E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

Mid-Michigan—Nov. 15

Elks Club, Flint Mich. Dinner 6:30 p. m., meeting 8:00 p. m. Creativity in Engineering—John E. Arnold, prof. mech. engrg., Mass. Inst. of Tech., Cambridge, Mass. Cocktail Hour courtesy A. C. Spark Plug Division, G. M. Corp.

Montreal—Nov. 15

Sheraton Mount Royal Hotel. Dinner 7:00 p. m., meeting 8:00 p. m. Rolls Royce Aircraft Engines—Air Commodore E. R. Pearce, public relations officer, Rolls Royce of Canada, Ltd.

Northern California—Nov. 17

Alexander Hamilton Hotel. Dinner 6:30 p. m., meeting 7:30 p. m. Economy Fuels for Diesel Locomotives—Paul V. Garin, engrg. of tests, Southern Pacific R. R., San Francisco, Calif.

Philadelphia—Dec. 8

Engineers Club. Dinner 6:30 p. m., meeting 7:45 p. m. Fuels and Lubricants Meeting. Speaker to be announced.

Southern California—Dec. 13

Rodger Young Audtitorium, Los Angeles. Dinner 6:30 p. m., meeting 8:00 p. m. Piggy Back Crystal Ball—F. H. Hemphill, asst. gen. freight agent, Santa Fe Railway Co., Los Angeles, Cal.

Southern New England—Dec. 2

Hartford, Conn. Dinner 6:45 p. m., meeting 8:00 p. m. Automations—Charles F. Hautau, pres, Hautau Eng. Co., Detroit, Mich.

Spokane Intermountain—Dec. 9

Desert Caravan Inn. Dinner 6:30 p. m., meeting 7:30 p. m. Representative of Fairchild Air Force Base, Fairchild, Wash.

Syracuse—Dec. 9

Army Tank Production—James F. Kerrigan, pres. & gen. mgr., New Process Gear Corp.

Texas—Nov. 12 and Dec. 10

Hilton Hotel, Fort Worth. Social Hour 6:00 p m., dinner 7:30 p. m., meeting 8:30 p. m. Aircraft Design.

Dec. 10—Contour Forming by the Shot Peening Method—Plastic bonding in sports car design and affiliated problems.

Virginia—Nov. 22

William Byrd Hotel, Richmond, Va. Social hour 6:30 p. m. Dinner 7:00 p. m., meeting 8:00 p. m. Use of LP Gas As a Motor Fuel—F. E. Selim, Phillips Petroleum Co., Bartlesville, Okla.

Washington—Nov 16 and Dec. 7

Dinner 6:30 p. m., meeting 8:00 p. m. The Mighty-Mite—Clarence Summers, exec. vice-pres. and Pete Peterson, chief engrg. of Mid American Research Corp. of Wheatland, Pa. Mighty-Mite is a one quarter ton 4 × 4 lightweight truck designed for high mobility, maneuverability, and versatility yet compact and light enough to be air transportable. Films of the Mighty-Mite in action will be shown.

Dec. 7—Washington Aviation Club. Social hour 6:15 p. m., dinner 7:00 p. m., meeting 8:00 p. m. How Do We Fly From Here? 1954 SAE President, William Littlewood.

SAE Wichita Section Utility Aircraft Meeting

November 12 and 13 — **Broadview Hotel, Wichita, Kansas**

Technical Sessions on November 12 on Utility Aircraft will feature . . .

Engines — Structural Design and Static Testing — Propeller Design — Communication Equipment — Navigation Equipment

Simultaneous Production Sessions on November 13 will highlight . . .

Inspection Techniques — Machining Techniques — Tool Design — Forming — Fabrication

Following dinner on Friday, November 12 there will be a lecture on

Commercial Usage of Air Transportation

Continued from page 99

facturers, medical researchers and operators in this field. It has come up with information that can be used by designers as criteria in future high altitude aircraft design. Here are some of the findings:

Ventilation requirements for passengers are about the same as during low altitude flight. Changes in altitude vary the volume of air flow in the cabin. Since this affects the rate of human body moisture evaporation, temperature and humidity have to be adjusted for comfort.

Slightly higher air temperatures are required. This is because the air supplied to the cabin has low humidity and body mositure evaporates quickly resulting in greater cooling.

Humidity in the plane should not be allowed to rise to such a level that the dew point temperature is higher than the temperature of the plane's interior surfaces. This will cause moisture condensation which may be harmful to equipment.

Cabin pressure in commercial airplanes must be maintained at least equal to atmospheric pressure at 8000 ft. Loss of pressure at high altitudes may injure passengers because of the rapid expansion of gases within the lungs, sinuses, and intestines. Lung hemorrhage or the formation of nitrogen bubbles in the body when pressure is dropped rapidly can be crippling and sometimes fatal. Also, the low partial pressure of oxygen at high altitudes makes it difficult for the body to get enough oxygen. Unconsciousness and death will occur if protective measures are not taken.

At altitudes above 50,000 ft breathing oxygen will not prevent loss of consciousness when pressure is lost. However, the chances for recovery and survival are very much better. Naturally, the better the oxygen equipment and the sooner it is used after decompression the greater will be the possibility of survival. Fig. 1 shows the rate of descent necessary to maintain consciousness following a loss of pressure of approximately one second duration.

Commercial flight at these dangerous altitudes is feasible only if adequate precautions are taken to make the possibility of an uncontrolled decompression as remote as a major structural failure. Windows must be designed so that failure of a single panel will not completely depressurize the plane. Doors and hatches must be protected against accidental openings. And there must be more than one source of pressure in case of mechanical failure.

The success of high altitude commercial flight will depend upon the careful designing and integration of air conditioning equipment into the airframe structure. A dependable pressurization system is essential for safety, and adequate temperature and humidity control is necessary for comfort.

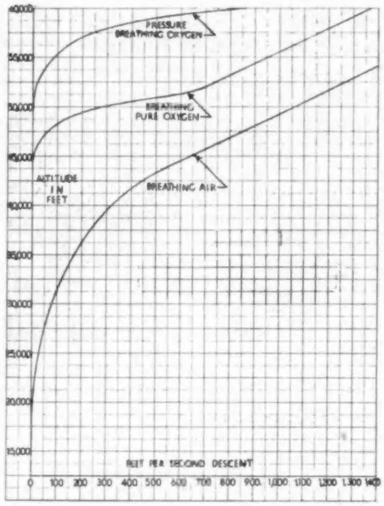


Fig. 1—This shows the rate of descent necessary to maintain consciousness following a loss of pressure of approximately one second duration. Note above 50,000 feet breathing oxygen will not prevent loss of consciousness when pressure is lost.

Cable Terminals Standard Revised

A COMPREHENSIVE new revision of the SAE Standard on Cable Terminals says, "Terminals may be applied by crimping, welding, swaging, soldering, or any combination."

The revision was approved by the SAE Technical Board in October. It is the work of the Conduits, Cables, and Wiring Subcommittee of the SAE Electrical Equipment Committee.

The new revision specifies dimensions of the connection end of the terminal only. It does not stipulate the method of attachment. The dimensions specified for the connection end are those in current practice.

Special Tools Speed Avon Engine Production

Based on paper by

A. F. KELLEY

Rolls-Royce, Ltd.

ROLLS-ROYCE has devised special machine tools and equipment at modest cost to reduce the man hours required to build the Avon engine. Many of these it has built itself, due to the overcrowded machine tool industry, to meet production schedules for the United Kingdom and NATO.

Among such tools, for example, is a twin turning attachment for machining both sides of compressor disc webs at once. These webs must be machined to a thickness of 0.075 in. and maintain a high degree of accuracy. Previously the operation was performed in two parts which resulted in buckling. With the twin turning attachment the two tools are horizontally opposed so that one reacts against the other and acts as a steady. For machining this web in light alloy, a cutter feed of 0.002 in. and speed of 600 rpm is used. (Paper "Some Production Aspects of the Avon Series of Aero Engines" was presented at SAE National Aeronautic Meeting, New York, April 14, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Motored Engine Tells Combustion Facts

Based on paper by

WILLIAM C. DAVIS
MARION L. SMITH
EARL W. MALMBERG
and
JANE ANN BOBBITT

The Ohio State University

Complete paper will be printed in 1955 SAE Transactions

ARE the types and concentrations of intermediate-combustion products formed in a motored engine comparable to those produced by precombustion reactions within the unburned end gas of an engine employing spark ignition and normal combustion?

To answer this question an investigation was conducted with a CFR engine, type F-4, and the following conclusions reached:

1—The same types of carbonyl products were formed by precombustion reactions in both motored- and fired-engine tests.

2—The maximum specific yields of these compounds were approximately the same when a given fuel was compressed with comparable pressure-temperature-time histories in both the motored- and the fired-engine tests.

3—Variations of the specific yields of carbonyl intermediates with crank angle positions were similar for the motored- and fired-engine tests except for a phase lag of about 10 crank angle degrees.

4—Essentially the same types of intermediate compounds were found with n-pentane, n-heptane, isooctane, propane, propene, and cyclohexane, though the concentrations of the carbonyl compounds formed and the engine operating conditions required to produce vigorous precombustion reactions differed markedly for the several fuels.

5—The motored engine offers a much greater degree of control over the reactions, and facilitates the sampling technique.

(Paper "A Comparison of the Intermediate-Combustion Products Formed in an Engine With and Without Ignition" was presented at SAE Annual

Meeting, Detroit, Jan. 14, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Based on Discussion . . .

T. J. Schweitzer, O. A. Uyehara and **P. S. Myers, University of Wisconsin.**

It is extremely difficult to obtain comparable pressure-temperature-time histories in fired and motored engines at the same rpm. Pressures and temperatures comparable to those achieved in the end gas of the fired engine can be reached in the motored engine only when the time factors are comparable and the time factors are more nearly comparable when the motored engine is operated at a higher rpm than the fired engine.

A. Ross, Ethyl Corp.

The authors point out that although the term "equivalent (or comparable) history of pressure, temperature and time" is applied to fired and motored engines, they are not the same histories. This needs stressing. Even the equivalence of the histories is deduced rather than proven. It can be reasoned correctly that since the products obtained are the same, then, whatever these histories were, they must be in some way equivalent. But the argument cannot be reversed to say that equivalent histories are shown to produce the same products.

Extended studies in the Ethyl Corp. Research Laboratories have not succeeded in giving us accurate time-temperature-pressure histories for fired engines at all, and there is no comprehensive published report of such for comparison with histories obtained for motored engines.

The paper represents a forward stride in our understanding of fuel combustion chemistry, since it shows successfully that intermediate carbonyl products formed in a motored engine are also produced in a spark-ignited engine. However, great caution is advised in any attempts to relate these products to knock.

Balanced Brakes Essential for Safety

Based on paper by

F. C. HILE

Warner Electric Brake & Clutch Co.

Complete paper appeared in 1954 SAE Transactions

THERE are mechanical factors, often overlooked but controllable by proper maintenance, which affect brake balance regardless of the brake location or type of brakes used. These must be taken care of before "push button" braking is desirable. They are:

1—Smooth tires on one wheel and good rubber on the opposite wheel.
2—Only one brake relined and then not with the same specification of the other brake.
3—Drums not close to being the same diameter. One may be concentric, the other eccentric.
4—Loose wheel bearings.
5—Unbalanced loads over the wheels.

Electricity has won general acceptance as applied to trailer brake systems because it can be synchronized with either air or hydraulic systems used on tractors. Since it is the fastest known medium, electrically actuated brakes are fast upon application and release. This reduces the problem of brake balance to one of balancing brake build up time, or as it may be termed, brake retardation. It can be accomplished by having the two types of brakes build up simultaneously for their respective axle loads and tire sizes.

The elimination of application delay

in the brake system of articulated vehicles allows all brakes to function simultaneously. Shorter stops may be expected while jack-knifing, caused by applying either the tractor or trailer brakes ahead of the other, is reduced to a minimum. With all brakes applying and releasing together each is carrying its share of the brake load. This is important from the standpoint of temporary heat fade and excessive wear which often causes brake failure without warning. Proper loading, driver ability, and sound maintenance, however, are also contributing factors to brake fade and excessive wear. (Paper "Coordination of Electric with Other Braking Systems" was presented at SAE Annual Meeting, Detroit, Jan. 11, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Throws New Light On Preflame Reactions

Based on paper by

D. R. OLSON

Yale University

J. T. WENTWORTH

and

W. A. DANIEL

Research Laboratories Div., General Motors Corp.

Complete paper appeared in 1954 SAE Transactions

AN improved method has been developed for evaluating the energy release rate which occurs during preflame reactions in engine. It can be applied to either motored or fired engines. In the latter case it is valid up to the point in the engine cycle when the spark is fired.

With this method it has been possible to obtain a smooth energy release rate curve. Two previous methods of analysis do not show this detailed effect, although the mean rate of energy release as determined by all three methods is in general agreement.

Since this method requires data from a non-reacting mixture test to evaluate the heat transfer effects of the engine, various inlet mixture temperatures of the non-reacting fuel were combined with a given set of reacting mixture data to determine the effect upon the energy release results. Although some variation of the energy release time-history is evident from these data, the essential features of the energy release rate curve are obtained.

The total energy release per mole of charge as a result of preflame re-

actions is dependent both on the fuel and engine conditions. This confirms the findings of previous investigators. It was also found that for one fuel-air mixture the total energy released per mole of charge as a result of preflame reactions is relatively independent of the inlet mixture temperature, thus confirming the hypothesis of other investigators. Finally, a correlation was found to exist between the energy release rate and the radiation effects of preflame reactions. (Paper "The Evaluation of the Energy Released During Preflame Reactions" was presented at SAE Annual Meeting, Detroit, Jan. 14, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Based on Discussion . . .

O. A. Uyehara and P. S. Myers,
University of Wisconsin

THE authors maintain that varying the mixture temperature of the nonreacting mixture should not vary the conductance. However, varying the mixture temperature varies the density of the charge. Since the mixture temperature was not changed, we must conclude that the density does affect the conductance.

E. B. Rifkin,
Ethyl Corp.

Since numerous investigators, including the authors, have shown that cool flames are closely related to the energy liberated by precombustion reactions, this raises the question as to whether the motored engine data which show appreciable heats of precombustion reactions also involve a cool flame traversing the chamber. If they do, which seems quite likely, then the treament of these data by the authors, as well as the two groups of earlier workers, must be further investigated to show that only homogeneous systems are involved. If a cool flame front is present when the reaction heat is liberated, these methods are probably invalid.

Let's Simplify Air Conditioning Tests

Based on paper by

W. E. DIEFENDERFER
United Aircraft Corp.

THE realistic approach to the testing of aircraft air conditioning equipment might be defined as a philosophy resulting in a test program which, to as great an extent as posible—

1—Assures the suitabilty of the tested item for the service intended.
2—Is not so arbitrary and restrictive as to preclude the attainment of other important objections such as weight, bulk, and cost reduction.
3—Uses experience and technical knowledge and does not arbitrarily demand complete test proof where less testing plus engineering and experience can predict the results as capably.
4—Takes cognizance of the possibilities to foreshorten time in test and keeps a balance between test requirements and those of the scheduled need for the item.
5—Pays attention to the economics of testing, since a complete blindness to this factor can seriously curtail our necessary military aircraft output, or can reduce the saleability of American commercial aircraft.

This approach to testing might include as a first step a thoughtful reappraisal of the "standard" test speci-

cations, and a careful writing of each "arbitrary" test procedure.

The temptation at times is to convert the system test into a continuing endurance or qualification program. There may be instances where some of this is justified. In general, however, components employed in the system test have already been successfully qualified. The aim of this phase of the program — compatability — should be kept as a guiding principle.

Even in the testing of individual components, simplification can be achieved without sacrificing surety. Adequate procedures often can be evolved which do not require the operation of associated pieces of equipment. Savings in time, simplified programming, and reduced equipment demands can often be achieved. In many cases, the actual operating conditions or transient characteristics can be transposed intelligently to other conditions. This may provide satisfactory experimental proof of proper function with reduced complexity of the test setup. Endurance tests can be specified at conditions which provide rates of attrition of known relation to the average operatiton. They do not need to involve the actual length of service or the true operating schedule. The only amber light to observe here is that these tests can tend to become arbitrary or ultra conservative and as a consequence violate the first theme. There seems to be adequate room between the two extremes in which to operate.

Just as quality cannot be inspected into a product but must be built into it, so performance and life cannot be tested into a product; these have to be engineered into it. Greater and greater reliance on the test process can result in less and less emphasis on good design, basic engineering, and research. The aircraft industry cannot afford a trend in that direction. (Paper "A Realistic Approach to the Testing of Aircraft Air Conditioning Equipment" was presented at SAE National Aeronautic Meeting, New York, April 13, 1954. It is available in full in multilithographed form from SAE Special Publications Department. Price: 35¢ to members, 60¢ to nonmembers.)

Based on Discussion . . .

Randolph C. Bready,

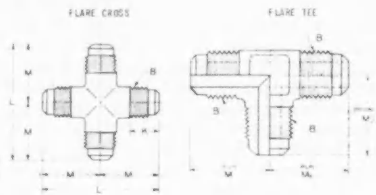
Bureau of Aeronautics

Utilization of experience and engineering knowledge as a means of reducing the amount of testing must be analyzed very carefully in this period of rapid advancement in air conditioning. In many instances it will not be possible to reach a valid conclusion based on experience with existing military equipment. The extent, therefore, to which this approach can be applied depends on the **detailed similarity** which exists between the test article and the unit referred to for background data.

SP News Special

FRIGID FITTINGS: The American Standard for refrigeration and marine fittings has recently been up-dated and the document is now available. Name your fitting, for marine or refrigeration uses—connectors, adapters, reducers, elbows, tees, crosses, caps and bonnets—and you'll find it in REFRIGERATION FLARE TYPE FITTINGS (ASA B70.1—1954).

The information in this Standard (SP-95), is illustrated in detail, as shown here.



Its authors say the new Standard is a big improvement over the old one, which left much to the user's imagination.

If you want to know more about the new Standard, be sure to read the article about it on page 97 of this issue. You can get a copy of the Standard for $1.00 if you're a member, $2.00 if you're not a member.

PEENING SPECIALISTS NOW HAVE ANOTHER IMPORTANT ITEM TO ADD TO THEIR KIT OF TOOLS. It's the just-published comprehensive review of peening articles.

It's titled SP-126, WHAT'S BEEN WRITTEN ABOUT PEENING (Supplement to SP-84, SAE Shotpeening Manual). It gives abstracts of 58 treatises on shotpeening and other forms of peening.

It's easy to use, gives a quick concise coverage of the field. The index by author and subject is a handy one. Price is $1.50 to members, $3.00 to nonmembers.

Coming Attraction: **BIBLIOGRAPHY ON RESIDUAL STRESSES, SP-125. (It'll be off the presses after November 15).** If fatigue plagues your products (few mechanical parts are immune to the hazard,) you'll find this exhaustive bibliography a good starting point for ridding yourself of the problem.

According to residual stress specialists, this compilation of references is

About Publications

the most thorough and useful one ever published.

The 1545 references it covers encompass practically all the domestic and foreign literature on the subject. You'll find the reference descriptions unusually helpful; they evaluate each item in pretty frank terms, tell what's useful in it, point out any shortcomings or weaknesses in the material. Author and source are carefully noted. The bibliography is listed at $5.00 to members, $10.00 to nonmembers.

THE LAST WORD ON BLAST CLEANING for engineers and shop men is here at last. It's a manual that contains everything you want to know about blasting abrasives, blast cleaning machines, production procedures and process specifications, as well as just plain top-flight instruction in blast cleaning.

Division XX of the Shotpeening, Iron & Steel Technical Committee put this little volume together. To get it, ask for SP-124—BLAST CLEANING MANUAL. $2.00 to members and $4.00 to nonmembers.

PRODUCTION IDEAS: We're sure everyone has heard by now of the wonderful attendance and great success of the 1954 Tractor Production Forum in Milwaukee last September 13. (See page 58 for the story on the Forum.) If you weren't able to attend, a copy of the secretaries' reports of the seven panel discussions will bring the substance of this gathering into your office. $1.50 to members, $3.00 to nonmembers.

Just issued—SP-122 ENGINEERING KNOW-HOW IN ENGINE DESIGN—PART 2—(second in a series of lectures on engine design sponsored annually by the SAE Milwaukee Section.)

Publication answers the question, "How does the specialist go about applying theory, test data, and empirical formulas to the design of an engine and its component parts?"

This report is recommended not only to the engineer in industry, but also to the student who will appreciate the spelling out of the practical engineering process in seven aspects of engine design. $3.00 to members, $6.00 to nonmembers.

New Members Qualified

These applicants qualified for admission to the Society between September 10, 1954 and October 10, 1954. Grades of membership are: (M) Member; (A) Associate; (J) Junior.

Baltimore Section

T. A. Levengood (A), James H. Rock (A).

Buffalo Section

Jerzy Cicero-Pienkowski (M).

Canadian Section

Michael Franklin Bederaux-Cayne (A), Frederick H. Beelby (A), William A. Coda (M), Joseph Thompson Purvis (M), Kenneth S. Stewart (A).

Central Illinois Section

Mel Michael Steele (J), Gordon Swardenski (M).

Chicago Section

Stanley W. Anderson (A), Fred A. Brown (A), John Moore Clifton (M), William J. Darley (J), Donald J. Flaherty (J), Leonard Hall Gerin (M), David E. Gow (A), Etlar August Henningsen (M), Osborn A. Kershner (M), O. J. Larson (M), Michael Leonard (J), James A. Neese (J), Norman Carl Schumacher (J), Wilkin H. Seacord (M), Wilbur L. Webb (M), Milton K. Wells (M).

Cincinnati Section

W. J. Barta (M), Frederic M. Curwin (M), Clifford J. Stewart (A), Joseph O. Young (A).

Cleveland Section

John L. Allen (A), J. A. Andrisek (M), Chester O. Bancroft (M), Warren C. Brandow (M), Bronislaw Thadeus Brzozowski (M), John William Collins (M), E. Mandell deWindt (M), Charles A. Griggs (M), Lester Murray (M), John W. Schulte (M).

Colorado Group

David H. Ruhl (A).

Dayton Section

John L. Ostborg (M), Joseph P. Ridolfo (J).

Detroit Section

James D. Brabant (A), Bert Walter Cartwright (J), Richard E. Denzer (J), George Fredrick Fell (M), Ralph K. Frey (M), Emil Norman Gillig (M), Richard O. Gordon (M), Wilfred R. Greaves (M), Russell Bernard Hebert (A), Gen. Doyle O. Hickey (M), Lyle Hoard (M), Jesse B. Howard (M), Galen W. Lavery (M), Thomas E. Lohr (M), Richard J. McHugh (J), Robert Clayton Mellin (J), David I. Nyquist

New Members Qualified

continued

(J), Fred Pradko (J), George Ralich (J), Harry L. Redding (M), John L. Rembowski (J), Rollin M. Russell (M), Thurman R. Sanders (M), Mario P. Vano (M), Clifford L. Wheeler, Jr. (J), Jack Kester Willis (J).

Hawaii Section

James F. Pell (A), Walter H. Grasser (M).

Indiana Section

John M. Dunnewind (M), George W. Feil (M), George Hollins (M), Arthur O. Wozencroft (A).

Kansas City Section

Philip G. DeHuff (M).

Metropolitan Section

John S. Andrews (A), Lloyd J. Britton (M), Thomas C. Coyne (M), Albert L. Japp (M), Lewis Johnson (A), Donald F. Kehn (J), John I. Nestel (M), Ledyard H. Pfund (A), Howard Alan Rosenberg (J), James M. Ryan (J), Harold Sydnor (M), George Tsakalos (A), Frank T. Woznak (A), John Earl Zabriskie (M).

Mid-Continent Section

John J. Casey, Jr. (M), John C Lewis (M).

Milwaukee Section

Earl William Blankenheim (A), Robert C. Brand (A), Robert N. Bullard (J), Wilbert Otto Gipp (M), William J. Vickio (M).

Mohawk-Hudson Group

Donald I. Evans, Jr. (J), John Allan Quiggle, Jr. (J),

Montreal Section

John G. Brown (A), Nicolae Floresco (M), Douglas Paterson Roberton (J).

New England Section

Thomas E. Franks (M), Herbert G. Hoefler, Jr. (J), Stuart W. Kneen (A), Edward Shub (A).

Northern California Section

Mickey F. Dukich (M).

Northwest Section

Richard H. (Hi) Smith (J).

Philadelphia Section

Sol Berman (M), Andrew J. Bozzelli, Jr. (J), Howard W. Carr (J), Philip P. Jefferis (A), George E. Kerr (A),

New Members Qualified

continued

Philip A. Plano (M), William David Preston (J), Laddy Allan Rice (M).

Pittsburgh Section

Donald Stewart Fraser (M), Milton L. Hancock (M).

St. Louis Section

George H. Dick (J), T. W. Havely (J).

Southern California Section

Whitley C. Collins (M), Carlton R. Davenport (M), Conrad M. Fritz (M), William F. Holtschulte (M), Seiji Kami (J), Irving F. Littman (M), William H. McClelland (M), Richard D. Peterson (A), Thos. W. Redfield (A).

Southern New England Section

John F. Batter, Jr., (J), Manfred Eugene Becker (J), Buel David Dean (A), Libero D. Ferrante (J), Paul R. Glazier (M), William Thomas Hegenberger (J), Daniel N. McNally (J), Ray Robbins (A), William Douglas Viets (A).

Syracuse Section

Maurice Fitzgerald (A).

Texas Section

Richard Van Alexander (J), Robert Niell Jones (M), Paul R. Welsh (J).

Twin City Section

Carl D. Johnson (A), Kenneth J. Miller (M).

Virginia Section

W. P. Bernard (A).

Washington Section

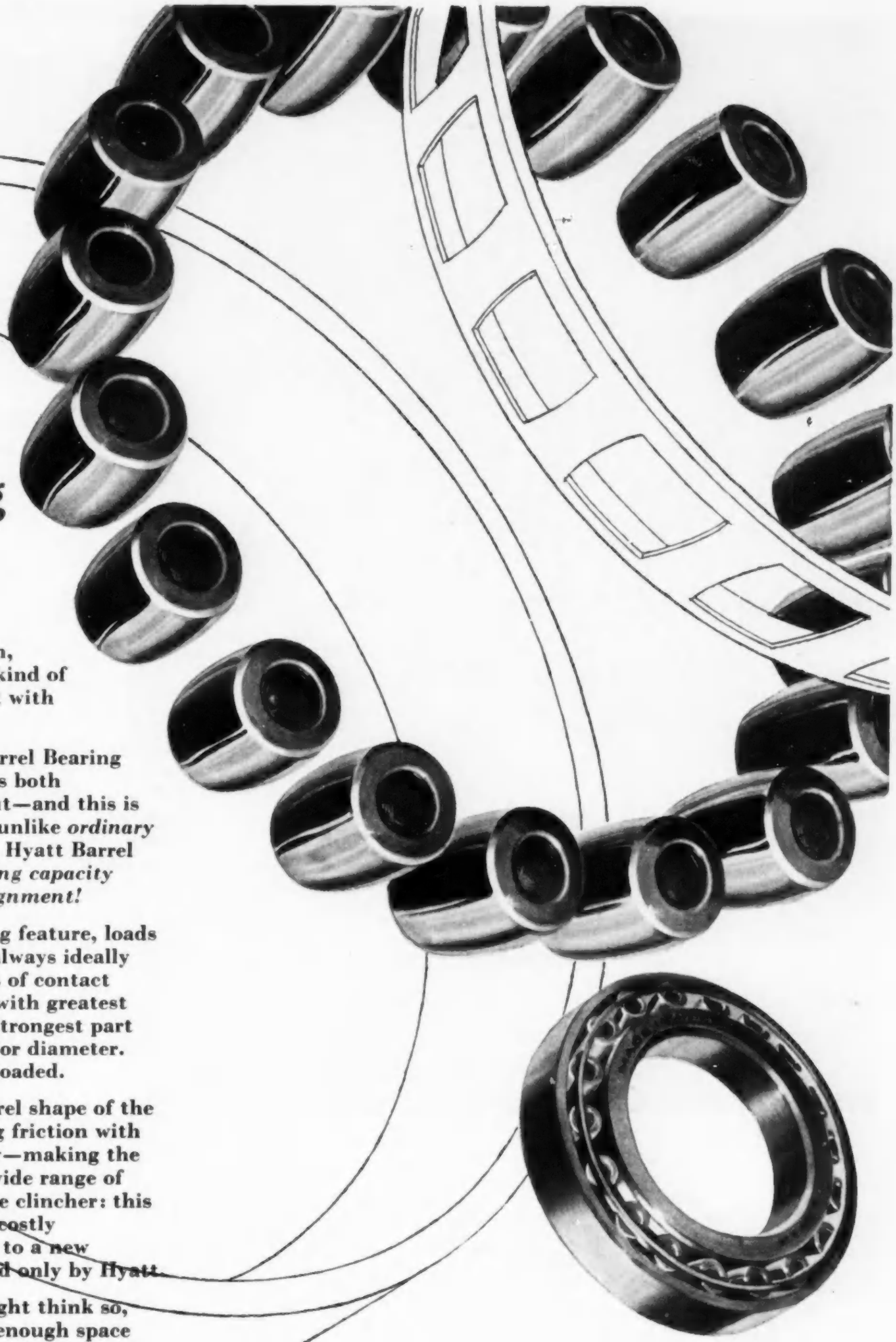
Frederick G. R. Cook (M), John A. Kiefner (M), Sumner Meiselman (M).

Outside Section Territory

Eugene Carpenter Coan (A), Joel Ferrell, Jr. (M), James K. Jensen (M), Howell C. Lowe (J), Keith A. Magalsky (J), Harold P. Marshall (M), John E. Mathews (J), Harlan W. Van Gerpen (J).

Foreign

Gustav Goldbeck (M), Germany; G. R. Graves (A), South Africa.



The barrel does the bearing job better

In the fight against friction, engineers are using a new kind of bearing . . . a bearing built with barrel-shaped rollers.

Developed by Hyatt, the Barrel Bearing is "dual-purpose"—it takes both radial and thrust loads. But—and this is the important difference—unlike *ordinary* dual-purpose bearings, the Hyatt Barrel *operates at full load-carrying capacity under conditions of misalignment!*

Because of this self-aligning feature, loads on the Barrel Bearing are always ideally distributed over large areas of contact between races and rollers, with greatest load concentration at the strongest part of the rollers—at their major diameter. Roller ends cannot be overloaded.

But that's not all. The barrel shape of the rollers combines low rolling friction with high load-carrying capacity—making the Barrel Bearing ideal for a wide range of applications. And here's the clincher: this superior bearing is far less costly than you'd expect—thanks to a new manufacturing process used only by Hyatt.

Does that cover it? You might think so, but it doesn't. There isn't enough space on this page to tell you everything about this new bearing. For full information, write to the address below.

HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

Applications Received

The applications for membership received between September 10, 1954 and October 10, 1954 are listed below.

Atlanta Group

Lewis S. Alexander, Stephen N. Bean, James A. Chappelka, William E. Fike, Reginald R. Kearton, Luther Don Loughridge, Jr., Goebel L. Owens, James B. Robinson, Harvey Q. Strother, David E. Walker.

Alberta Group

Gerald C. Wates

Baltimore Section

Robert R. Anthony, Arthur Bross, Leonard G. Rado

Buffalo Section

William M. Bradley, Jack A. Eckardt, James S. Entringer, Wesley Frederick Kofahl, George F. Reitmeier, Jr.

Canadian Section

Earl D. Brunt, James E. Elliot, Iain A. Gibbons, George M. Hood, Darius Irani, Clarence W. Kirkpatrick, Buddy C. J. Sinclair

Central Illinois Section

Jackson C. Medley, Gerald A. Wempner

Chicago Section

Robert A. Bamber, Alfred N. Cave, Bansun Chang, Richard D. Costley, Roy F. Dodgen, Edwin Gene Frisbie, James Edward Getz, Stephen E. Grenleski, Jr., E. V. Kallstrom, Lowell P. Martin, Hubert D. Minnis, Edward J. Musich, Jr., Paul F. Niessen, Pierce Richardson, James F. Schell, Harold E. Surface, Thaddeus J. Sawa, Donald C. Thompson

Cincinnati Section

F. Douglas Baker, Leo Donald Couch

Cleveland Section

Donald J. Diemer, Robert Jerry Kasper, Anthony B. Kubala, Ralph H. Riedel, Harold R. Scibbe, Benjamin A. Slupek, Paul Philip Terrano

Colorado Group

Donald I. Stahl

Dayton Section

James W. Day, Robert R. Flinn, Kenneth C. Lockhart, Glenn W. Periman

Applications Received

continued

Detroit Section

Lawrence T. Adams, Robert F. Anderson, Peter R. Angell, John Arko, Harry Vincent Arnberg, Clinton P. Atwood, Charles F. Baldwin, Jr., Nick Baracos, Bruce N. Barker, Arthur E. Bishop Louis M. Blanchette, James T. Bradburn, Frederick J. Button, Jr., Wendell P. Campbell, Paul D. Carleton, Edward J. Clarke, Dennis A. Davis, John William Dickerson, Don El Roi Dodds, Donavon Downham, Cecil H. Eggleton, Jr., John A. Ellis, Gene G. Engel, Robert I. Fannin, C. Jack Fehlberg, Max Fingeroot, Fred J. Finkenauer, Jr., Earl L. Fleming, Fred E. Freiheit, John S. French, Edgar R. Frost, Alexander Gherlan, Jr., William B. Gordon, Edward J. Gorman, George E. Gormly, Jr., Charles W. Greening, William L. Harris, Olaf S. Helland, Donald L. Heller, Alan K. Henry, Lewis E. Henyon, William A. Hermonat, Alec Eric Hewlett, Charles T. Hoffman, Carl D. Holdampf, Walter E. Hudyma, Robert L. Hurd, Henry B. Hutten, Jr., Herbert E. Jacobson, William G. James, Robert A. Jeffries, Gustav I. Johnson, James R. Johnson, Theodore, A. Kamrath, Carl V. Keranen, Robert J. Keyes, Jack B. King, Stanley F. King, Gilbert G. Kurop, Charles M. Levy, Lyle M. Lidikay, Harold A. Little, Stephen M. Lomakoski, Richard W. Longley, Joseph Malusovich, John I. Manecke, Wendell D. McGrath, John F. McMahon, Mario de Piedade Dias Miranda, Richard B. Miskin, Patrick R. Moore, Tom F. Movius, Franklin Vance Naugle, George J. Payne, Irving C. Peterson, Leo V. Peterson, Albert Rae Pitton, William A. Preish, Gene F. Riegler, Donald D. Roberts, Duane H. Rofe, Thaddeus C. Romans, Aaron D. Rosenstein, Samir Saaty, John L. Saffer, Charles Wesley Schwartz, Harold T. Shaw, Jr., Walter L. Shepherd, Joseph F. Smiley, Bert R. Smith, Lyle B. Smith, Adolph P. Speth, Thomas Spratt, Stanley C. Squires, Charles B. Steger, Andrew G. Swords, James Donald Symons, Sylvester T. Tafelski, R. F. Tomkinson, A. Roger Tyslan, George M. Vanator, Roger Voorhees, Bernard H. Watta, Louis Weberman, William L. Weeks, Gordon T. Wiggins, Kenneth L. Wheeler

Indiana Section

James A. Acker, John E. Ahlbrand, John H. Bradfute, Wilson D. Dysart, Ray Franklin Gong, Chester G. Good, Jr., Rine Kruger, Albert M. Mikolajczyk, Frank M. Watson

Applications Received

continued

Kansas City Section

Frank D. Froh, Henry H. Hart, James Madison Mathis, Wayne M. McCann

Metropolitan Section

Seymour Adler, Raymond E. Alden, Herschel V. Beasley, Bernard D. Benz, Donald B. Capwell, Franklin A. Cirino, Anthony C. Degutis, Angelo T. Deieso, Alexander DeStanko, Stephen V. Florkewicz, Bernard Harkins, Norman Kasschau, John G. Keller, S. Howard Lagerveld, Nicholas G. Lassios, Norman Levine, Francis Mangin, Bernard P. McPeck, Joseph V. Miccio, Samuel H. Miller, Richard Opsahl, Maurice B. Rice, William Arthur Rock, William F. Scanlin, Jr., Herbert Schulz, Harold N. Weinberg, George P. Werber, John Frederick Werner

Mid-Continent Section

David A. North, Frank D. Scott, Harold W. Torgeson

Mid-Michigan Section

James H. Diener, Robert Theodore Florine, Harold L. Fuss, William B. Hoffman, Fred Miller, Philip J. Passon, L. Harvey Petree, James D. Pidd, Byron F. Trenchard, Ernest O. Vahala, Burton A. Wilson, William R. Zeeb.

Milwaukee Section

Arden C. Degner, Roger B. Hunter, Lloyd A. Keyser, Alfred L. Seaberg, Carl F. Thelin

Montreal Section

H. Roy Runciman, Robert W. Thompson

New England Section

Everett Linwood Caswell, Jr., William H. Sargeant, Donald Leonard Stapinski

Northern California Section

Lester M. Hartmann., Burton W. Long, Howard E. Schmitz, Wilmer A. Spitzer

Northwest Section

Howard Earl Collicott, Eng Lan Foo, Glen Oscar Kerrebrock, Robert D. Lowe, Roderic C. Sowell

Applications Received

continued

Oregon Section

Brig. Mohan L. Chhabra

Philadelphia Section

Edward C. Ballard, Jack W. Cotton, Oscar W. Ehrman, Jr., August C. Kellermann, John O. Lutz, William A. McLaughlin, Joseph J. Mino, George C. Watson

Pittsburgh Section

Frederic W. Nave, Roland B. Sickler, LeRoy B. Thompson

St. Louis Section

Charles C. Dempsey, John T. Ellerman, Frank Perry Gross, Jr., Richard C. Hugo, Stanley A. Loring, Jr., Abraham Zukerman

Salt Lake Group

Myles Richard Burns, Prabhat G. Doshi, R. H. Richins, Wilford W. Snow

San Diego Section

Morris A. Barnett, Richard W. Cihak, James W. Creel, Alan M. Dale, Billy Dean Newberry, Evan M. Ogden, Duane Robert Prosser, George B. Swanson, Farrell Tipton

Southern California Section

Lucas L. Akana, Jack Azoff, James S. Alcorn, William L. Boren, Harry S. Brenner, Paul F. Brunner, Randolph B. Burbank, Donald R. Clarke, Osborne J. Eagan, Travis Page Eskridge, Kenneth G. Farrar, Robert L. Franzen, Robert E. Gillingham, Charles C. Griffin, John E. Helms, Jerry D. Hester, Richard Allen Hudson, Leslie J. Jacobson, Gustav V. Johnson, Jr., June H. Katow, David F. Kilpatrick, Robert Edgar Lockwood, Anthony M. Maggio, Henry Grady Marshall, James F. McLaughlin, Joe A. Montague, Charles M. Moreaux, Frazier Morino, Edward F. Mutz, David L. Potts, Robert T. Reid, Daniel F. Robins, William Joseph Ryan, Lawrence L. Saunders, Peter G. Senchuk, Lawrence S. Shapiro, Jack E. Styers, Richard L. Tonks, William B. White, Stephen F. Zavisa, Frank J. Ziegel

Southern New England Section

LeRennie Edwin Anderson, Esmond F. Bernier, Jr., Carl Edward Cousineau, Charles W. Darling, Floyd H. Fish, Jr.,

Applications Received

continued

Robert W. Lorimer, Jack Shirley Miller, James F. Olsen, Jr., Stephen Paliska, Jr., Wolfgang Simon, Harold Daniel Stetson

Syracuse Section

David D. Carrington, John P. Ullrich, Jr.

Texas Section

Charles T. Ashford, III, Jack K. Gilbert, John E. Ginn, Wayne Quinby Hanson, Bill R. Lewis, John S. Mead, William D. Reid, Robert H. Sumner

Texas Gulf Coast Section

Raymond L. Cappel, Tom Ferris, Walter K. Morris, Irwin Palmer, O. P. Puryear, W. W. Starr

Twin City Section

Arthur Richard Berg, Gordon E. Harms

Washington Section

John D. E. Egerton-Smith, John E. Fischer, David E. Guthrie, Jr., Morton Schler, Reginald Whitson

Western Michigan Section

Conrad Teichert, Jr.

Wichita Section

Lyman H. Welliver

Williamsport Group

James F. Hartman, W. H. Lorimer

Outside of Section Territory

Louis E. Bothell, Bobby J. Chapman, David T. Geddis, Louis Grabill, Russell Hastings, Jr., Donald F. Langenderfer, John A. Marvin, William Paul Moore, Donald S. Perry, Donald Gerald Riecken, William W. Seaton, William Frank Schmeling, Ralph D. Steele, John G. Trotter, Layton C. Tyner, Russell L. Valentine, Otha Howard Vaughan, Jr.

Foreign

Einar Gustaf Bohr, Sweden; G. Peter Wood, England; Manfred O. Kluth, Germany; C. S. Bhattacharyya, India; R. Chellappa, India; R. Viswanatha Kurup, India

We're Scheduling This Ad For 195X

LESS than three years ago, the revolutionary Thompson-engineered ball joint front suspension made the headlines. Already three of today's top passenger cars have adopted it . . . with other car manufacturers soon to follow suit.

Next? It won't be too long before the big news in the automotive world may be the adoption of Thompson's front suspension ball joints for *trucks and tractors, too!*

Then the "big fellers" of the automotive world . . . tractors and trucks . . . will also enjoy the advantages of:

- **Less driver fatigue**
- **Easier, safer steering**
- **Greater over-all stability**
- **Extra space for wider modern engine design**
- **Absence of front suspension and steering bind**
- **Lubrication points reduced from 12 to 4**
- **Increased service life *many times over***
- **Front end overhaul time cut *by hours***
- **Reduced manufacturer's assembly line costs**

This latest Thompson "Engineered Steering" development is typical of Thompson's cooperation with the Automotive Industry over the past 50 years.

Bring your steering linkage problems to Thompson's experienced engineers. Write, phone or wire Thompson Products, Inc., Michigan Plant, 7881 Conant Avenue, Detroit 11, Michigan, WA 1-5010.

You can count on

Thompson Products

MICHIGAN PLANT: • DETROIT • FRUITPORT • PORTLAND

Which is the CleCap?

. . . both are—all types and sizes of the vibration-proof Place Bolt

Place Bolts are used in all types of automotive and farm equipment, for example—in fly wheels, main bearings, connecting rods and other high vibration points.

Be sure you don't overlook the definite advantages of this *one-piece self-locking* fastener where you have a vibration problem—the *tough strength* developed by cold-forging, and the *economy of assembly* (elimination of locking devices and no limit to the number of times the Place Bolt may be re-used). Saves weight, saves space, saves time.

Licensed under U. S. Patent No. 2543705, CLEVELAND has facilities for mass production of sizes ranging from ¼" to 1¼" diameter, standard or special shanks, in carbon (C-5) or alloy (C-8) steel.

Write for guide chart for calculating wrench torques for "Place" type bolts.

The Cleveland Cap Screw Co.

2947 EAST 79TH STREET • CLEVELAND 4, OHIO
VU lcan 3-3700 TWX CV42

CLEVELAND *Top Quality* FASTENERS

Ferrous and Non-Ferrous: Bright, High Carbon and Alloy Steel Heat Treated, Brass, Silicon Bronze, Stainless Steel

- **Hex Head Cap Screws** — ¼" to 2½" dia.
- **Socket Head Cap and Set Screws** — Plain and Knurled: ¼" to 1½" dia. Also Flat and Button Head Styles
- **Flat Head Cap Screws**—¼" to 1" dia.
- **Fillister Head**—¼" to 1¼" dia.
- **Set Screws—Square Head**—¼" to 1½" dia.
- **Milled Studs**—¼" to 1¼" dia.
- **Place Bolts**—¼" to 1¼" dia.
- **Structural Bolts to ASTM Specification A325**
- **Tractor Bolts**
- **Special Hot and Cold Headed Parts**

Facilities to make larger diameters than listed

Originators of the Kaufman DOUBLE EXTRUSION Process


A real solution to an axle problem
THE CLARK DOUBLE REDUCTION AXLE (PLANETARY TYPE)
QUIET
QUALITY
COMPACT
RUGGED
DEPENDABLE
Do you use PRECISION GEARS ? CLARK produces them ...MOST TYPES, MOST SIZES
More and more manufacturers who want additional dependability and salability of heavy equipment are finding a positive solution to their power transmission problems in complete reliance on the 38 year experience of Clark engineering research. They know, from experience, that it's always "good business" to do business with Clark.
CLARK* EQUIPMENT
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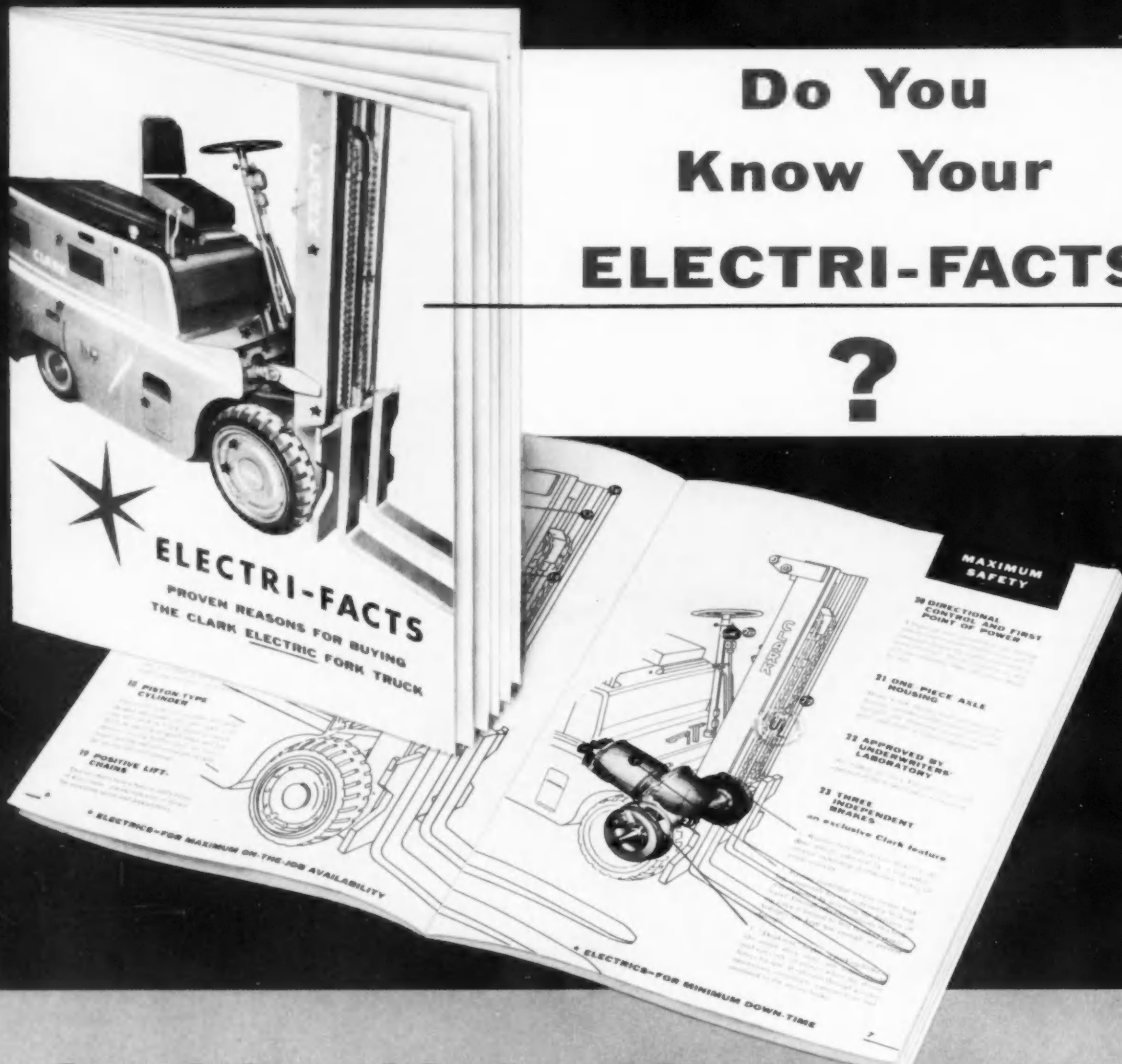
CLARK EQUIPMENT COMPANY, BUCHANAN, Battle Creek, Jackson, Benton Harbor, Michigan

Do You Know Your ELECTRI-FACTS ?



Send for this booklet

which shows and explains in detail the features of the Clark line of electric-powered lift trucks. The Electri-Facts Booklet disassembles the Clark electric truck to give you a mechanic's-eye view of all working parts—electrical control system, hydraulic system, power train, uprights, brakes, etc. Find out why Clark electrics give you better battery efficiency, why they operate a longer work-cycle than any other electric truck. Before you buy an electric truck, or any lift truck, you owe it to yourself to have the facts on Clark electrics. Use the coupon--send for your copy of ELECTRI-FACTS.

CLARK EQUIPMENT

Industrial Truck Division · CLARK EQUIPMENT COMPANY · Battle Creek, Michigan

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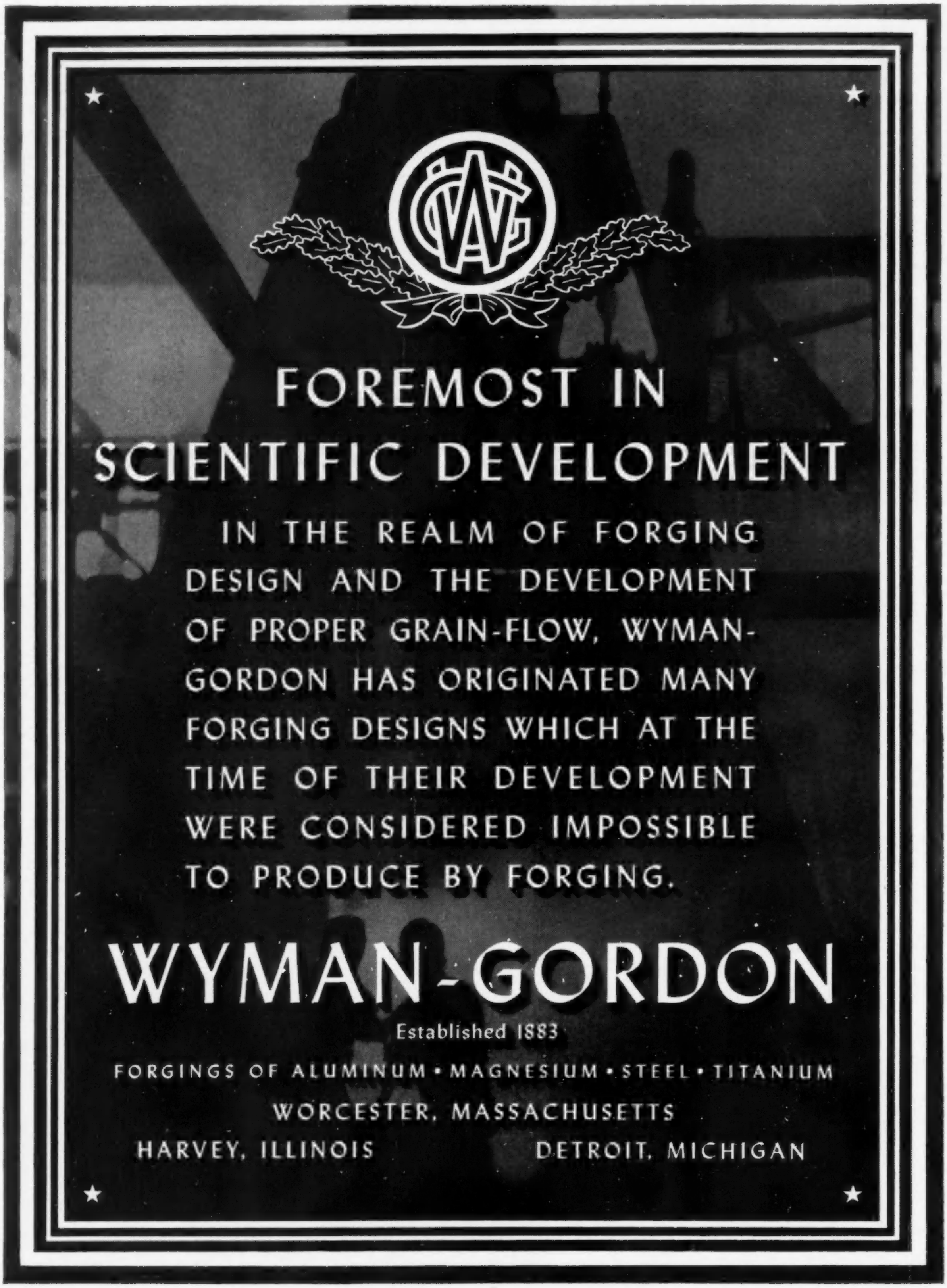
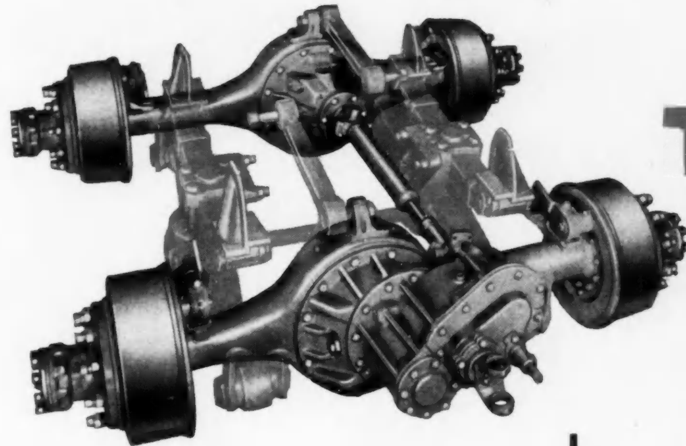
BUMP
SMOOTH IT OUT
WITH
DELCO
SHOCK ABSORBERS


FOREMOST IN
SCIENTIFIC DEVELOPMENT
IN THE REALM OF FORGING DESIGN AND THE DEVELOPMENT OF PROPER GRAIN-FLOW, WYMAN-GORDON HAS ORIGINATED MANY FORGING DESIGNS WHICH AT THE TIME OF THEIR DEVELOPMENT WERE CONSIDERED IMPOSSIBLE TO PRODUCE BY FORGING.
WYMAN-GORDON
Established 1883
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS
DETROIT, MICHIGAN

SIX reasons for the superior performance of EATON TANDEM DRIVE AXLES



1 Designed Specifically for Tandem Operation,
Eaton Tandem Axles are not subject to abnormal stresses or complicated lubrication problems.

2 Single Drive Line
on a normal angle gives a direct lead from power divider to rear axle; simplifies design, eliminates excess parts, minimizes maintenance.

3 Rugged Power Divider
mounted on forward axle, is of simple design; provides for transmission of power equally to both axles.

4 Inter-Axle Differential
in power divider assures equalized power transmission even though wheel speed may vary due to road irregularities or tire diameter variations.

5 Differential Lock-out
between forward and rear axles (optional on some models) provides positive drive to each of the axles, when required because of soft or slippery road conditions.

6 Maximum Strength with Minimum Weight
is achieved through simplified design, experienced engineering, and accurate fabrication.

Eaton Tandem Drive Axles provide trucks with greater load capacity—reduce tire and operating costs.

EATON AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

EATON

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

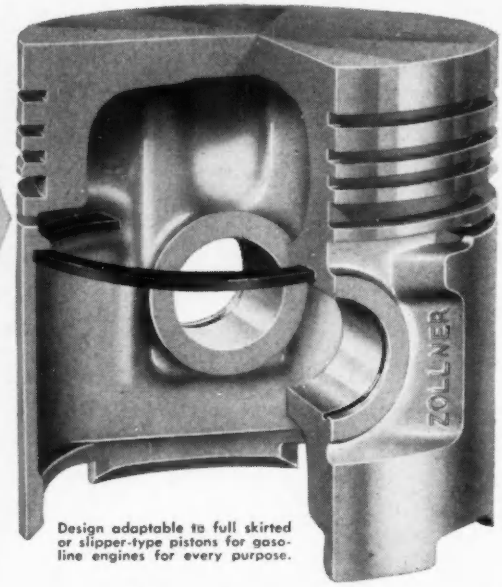
Sensational Piston Performance

UNIFORM CLEARANCE AT ALL TEMPERATURES

STEEL TENSION MEMBER

Anchored only at pin bosses and cast in positive contact with I. D. of piston skirt

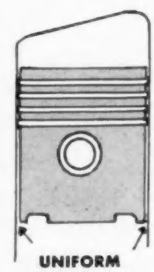
Controls Clearance Automatically



Design adaptable to full skirted or slipper-type pistons for gasoline engines for every purpose.

ZOLLNER CLEAR-O-MATIC PISTONS

Now, pistons may be fitted to closer clearances than ever before possible. The sensational development of CLEAR-O-MATIC Pistons by Zollner engineers *reduces required clearance to less than .001 with constant uniformity of skirt bearing over the entire temperature range.* Performance results are spectacular. Engines run quietly with no cold slap. Friction is reduced without loss of durability or heat conductivity. There is no danger of scuffing or seizing. The Zollner designed steel tension member incorporates in the aluminum piston the same effective expansion as the ferrous cylinder itself. We urge your immediate test of these sensational advantages for your engine.



UNIFORM EFFECTIVE SKIRT CLEARANCE AT ALL TEMPERATURES

1. Clearance maintained uniformly at all coolant temperatures from 20° below zero to 200° F.
2. Effective expansion identical with ferrous cylinder.
3. Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
4. Normal diametric clearance usually less than .001 with uniform skirt bearing.
5. Durability and conductivity comparable to heavy duty design.

ZOLLNER PISTONS — **THE ORIGINAL EQUIPMENT PISTONS**

ZOLLNER

- **ADVANCED ENGINEERING**
- **PRECISION PRODUCTION**

in cooperation with engine builders

ZOLLNER MACHINE WORKS • Fort Wayne, Indiana

Man,
Detail View of New
Spicer Center Bearing Mounting
PATENT PENDING
50 YEARS OF
Spicer
SERVICE
DANA CORPORATION

what a relief!

Revolutionary New Spicer Center Bearing Mounting for Spicer Propeller Shafts

REDUCES VIBRATION UP TO 80%
LENGTHENS TRUCK AND PARTS LIFE
LESSENS DRIVING FATIGUE

Happy days ahead, for many drivers of 1955 trucks!

The new Spicer Center Bearing Mounting has put the shackles on destructive, annoying propeller shaft vibration ordinarily transmitted through center bearing supports!

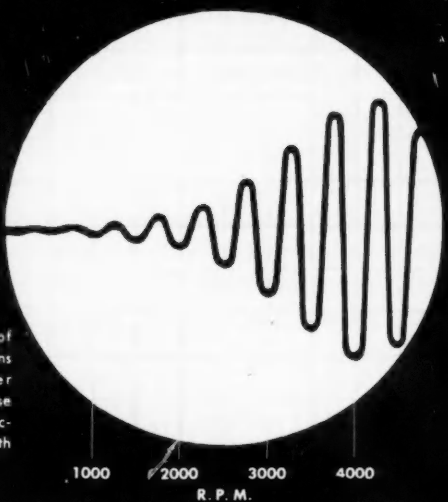
Gone is the propeller shaft hum . . . the buzz . . . the penetrating, nerve-wracking oscillations that weary the driver's body and wrack the truck's frame.

The Spicer Center Bearing Mounting embodies a revolutionary combination of ball bearing and low-frequency rubber. This achieves remarkably low vibration transmissibility at driving speeds. It dampens . . . deadens . . . absorbs nearly all the vibration disturbances transmitted to it from the drive line.

The new Spicer mounting is an outstanding engineering advancement. It is as momentous and far-reaching in effect as the now-famous soft-rubber engine mounting principle. One ride in a truck equipped with this Spicer unit will quickly prove its driver-saving, truck-saving ability.

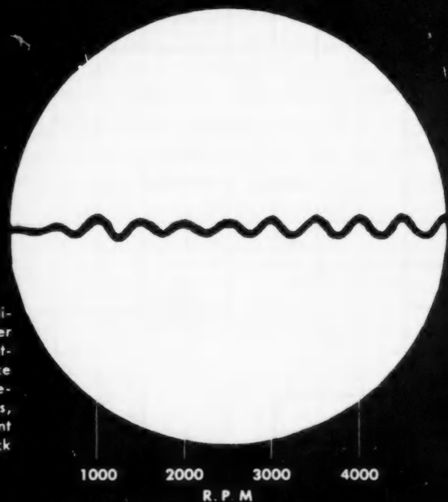
The new Spicer Center Bearing Mounting is available for original truck equipment, as an integral part of the Spicer Propeller Shaft assembly. It is another Spicer engineering "first," typical of Spicer pioneering that has been dedicated to the advancement of the automotive industry.

Oscillograph Recording of Standard Center Bearing Mounting



Extreme variation of amplitude of vibrations in standard center bearing mounting cause excessive and destructive vibration to both truck and driver.

Oscillograph Recording of New Spicer Center Bearing Mounting



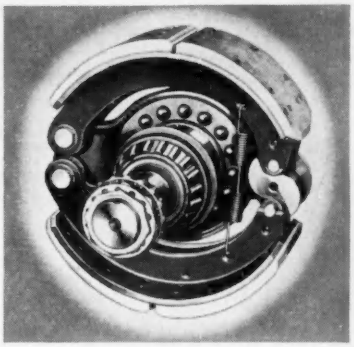
Small modulus of vibration in new Spicer Center Bearing Mounting indicates absence of annoying, trouble-making frequencies, assuring more pleasant and profitable truck operation.

TOLEDO 1, OHIO

SPICER PRODUCTS: TRANSMISSIONS • UNIVERSAL JOINTS • PROPELLER SHAFTS • AXLES • TORQUE CONVERTERS • GEAR BOXES • POWER TAKE-OFFS • POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES • STAMPINGS • SPICER and AUBURN CLUTCHES • PARISH FRAMES

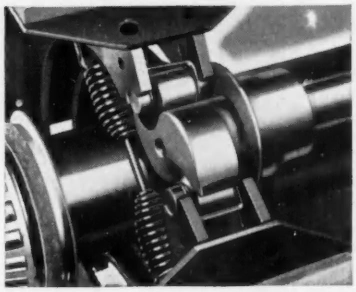
6 reasons why Timken-Detroit quality axles and brakes are specified on more truck-trailers today than any other make!

1. (left) Timken-Detroit trailer axles are lighter to give the greatest possible pay load. TDA trailer axle and brake assemblies are proved far stronger, more rugged in "Torture Chamber" tests. Note how TDA pressed steel brake shoes alone save many pounds per axle over cast shoes.



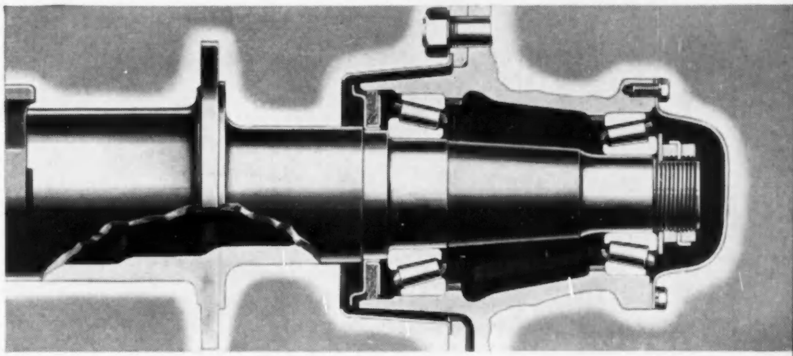
2. (left) Exclusive ¾" TDA "Econoliner" brake liners. Thickest at center where greatest wear occurs. Taper down at ends. Held rigidly by 12 deep set rivets per block. Spider riveted to flange. New design decreases operating temperatures, increases safety, cuts down excessive wear.

3. (right) TDA cam roller mountings will never seize. Roller will not brinell in camshaft. Note clean finish . . . heavy stamped steel straddle support for long life.

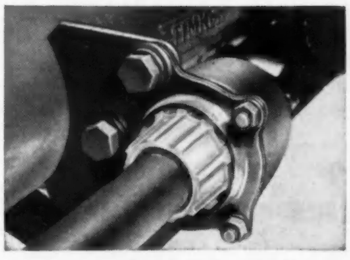


knots

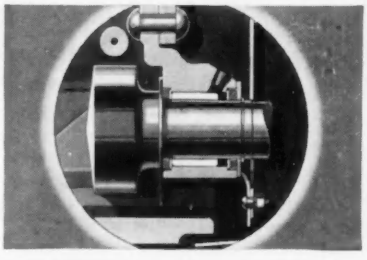
MEMBER TRUCK-TRAILER MANUFACTURERS ASSN.
T.T.M.A.



4. TDA forged alloy steel spindle, electrically welded to seamless tube. Brake mounting flange forged integral with spindle. Duplicates of this are constantly "Torture-Tested" to check on quality and workmanship.



5. TDA self-aligning camshaft support bracket. Spherical support for instant alignment during assembly or replacement. Nylon camshaft bushings wear up to 4 times as long.



6. Cutaway view shows cam mounted in new nylon bushing. Minimum wear even when bushings are not lubricated or improperly lubricated. Cannot rust, corrode or flatten out. Save weight.

TIMKEN Detroit AXLES

TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN

The Accepted TDA Standard
TRADE MARK REGISTERED

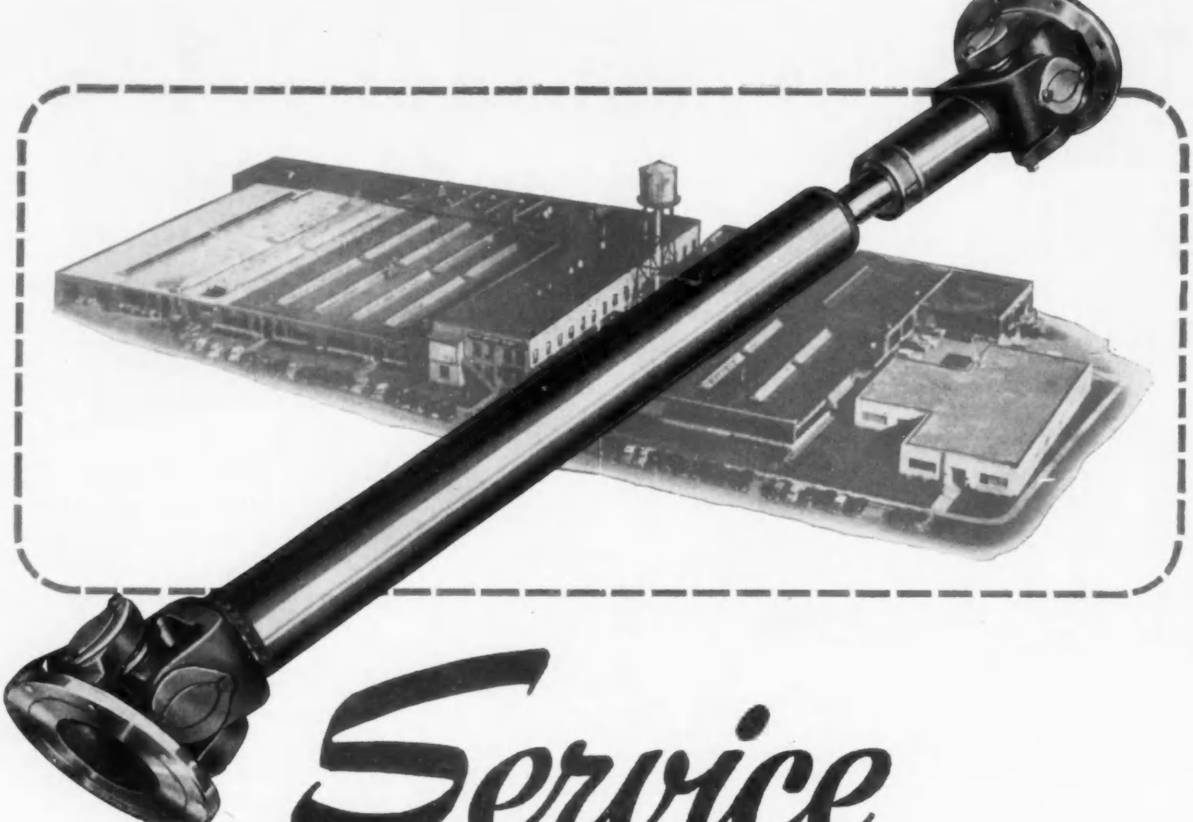
"TORTURE-TESTED"
to Save Money on the Job

All leading Trailer manufacturers specify Timken-Detroit safety tested quality built axles and brakes

WORLD'S LARGEST MANUFACTURERS OF AXLES FOR TRAILERS, TRUCKS AND BUSES

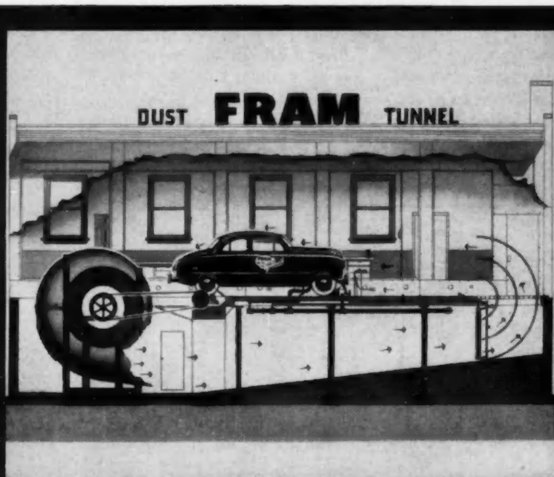
Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York • Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

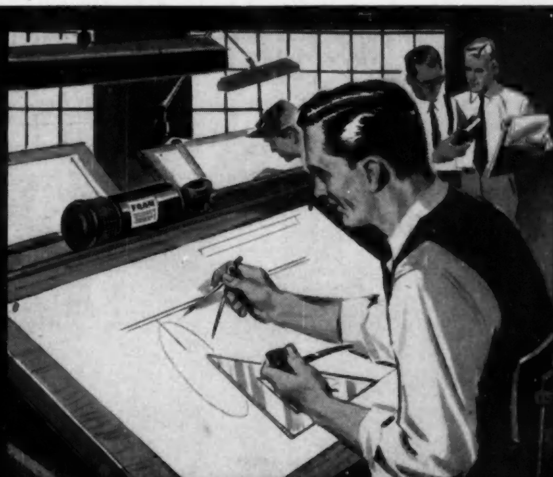

AUTO-LITE



FRAM

leads the industry





IN RESEARCH . . .

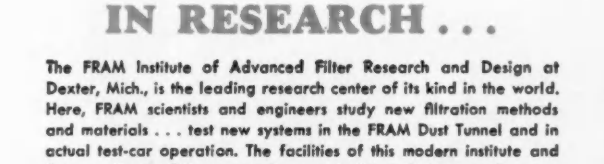
The FRAM Institute of Advanced Filter Research and Design at Dexter, Mich., is the leading research center of its kind in the world. Here, FRAM scientists and engineers study new filtration methods and materials . . . test new systems in the FRAM Dust Tunnel and in actual test-car operation. The facilities of this modern institute and the experience of its personnel are available to help you solve your filtration problems.

IN DESIGN . . .

No other filter manufacturer matches the variety and scope of FRAM products—proof of FRAM'S leadership in design. FRAM engineers also work closely with automotive manufacturers in designing special filter systems to exact automotive specifications and requirements. Whatever your filtration needs in . . . oil, fuel, air or water . . . consult FRAM.

AND DEVELOPMENT

of better filtration for oil, fuel, air, water

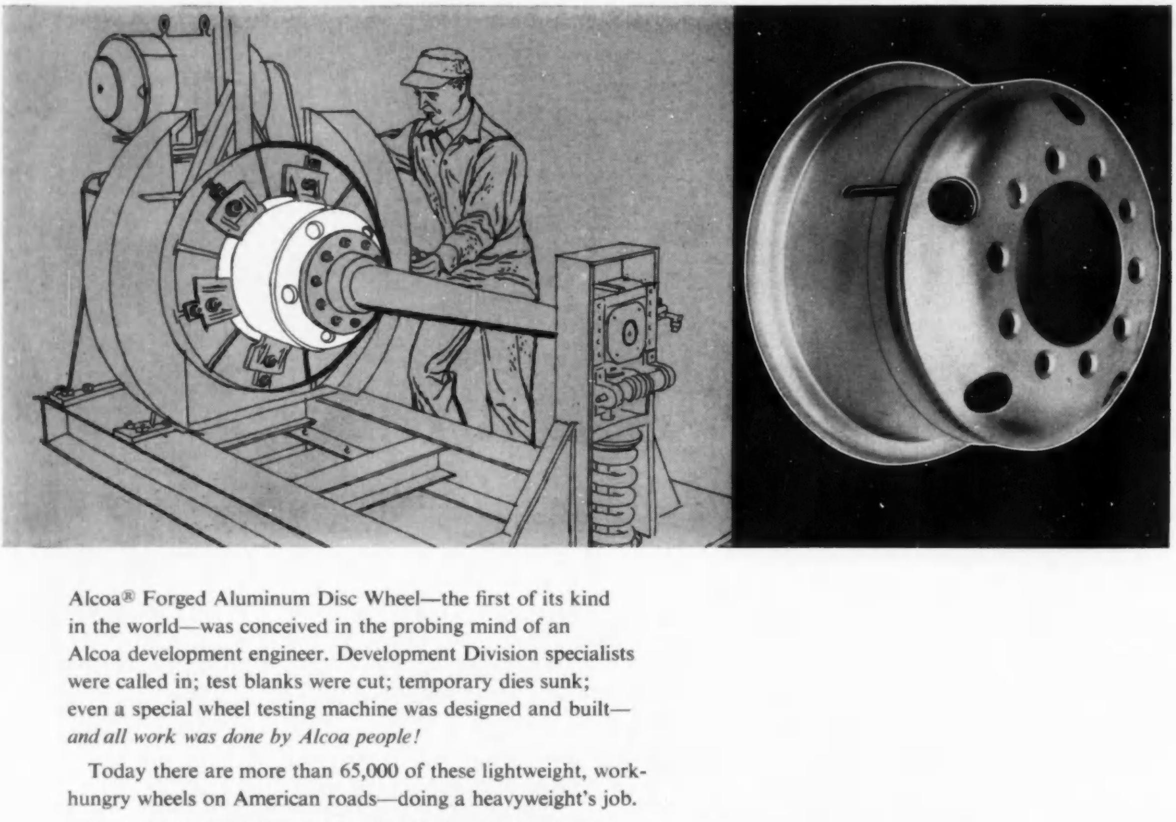


FRAM
OIL • AIR • FUEL • WATER
FILTERS

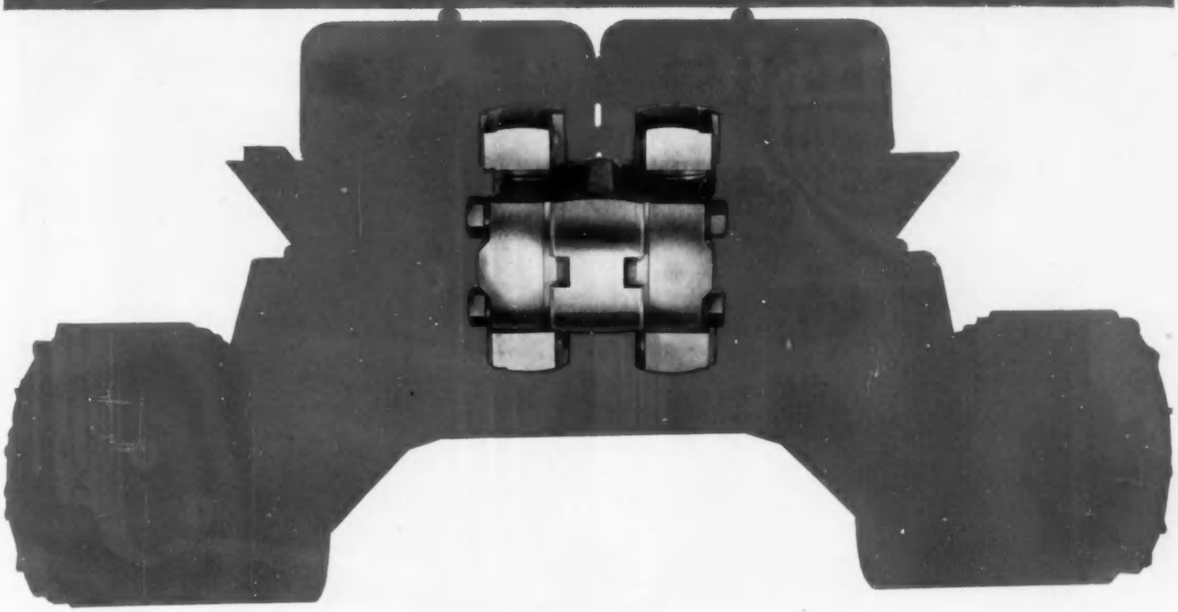
Write:
FRAM CORPORATION,
Providence 16, R.I.

Fram Canada Ltd.,
Stratford, Ont.

®



COMPACT



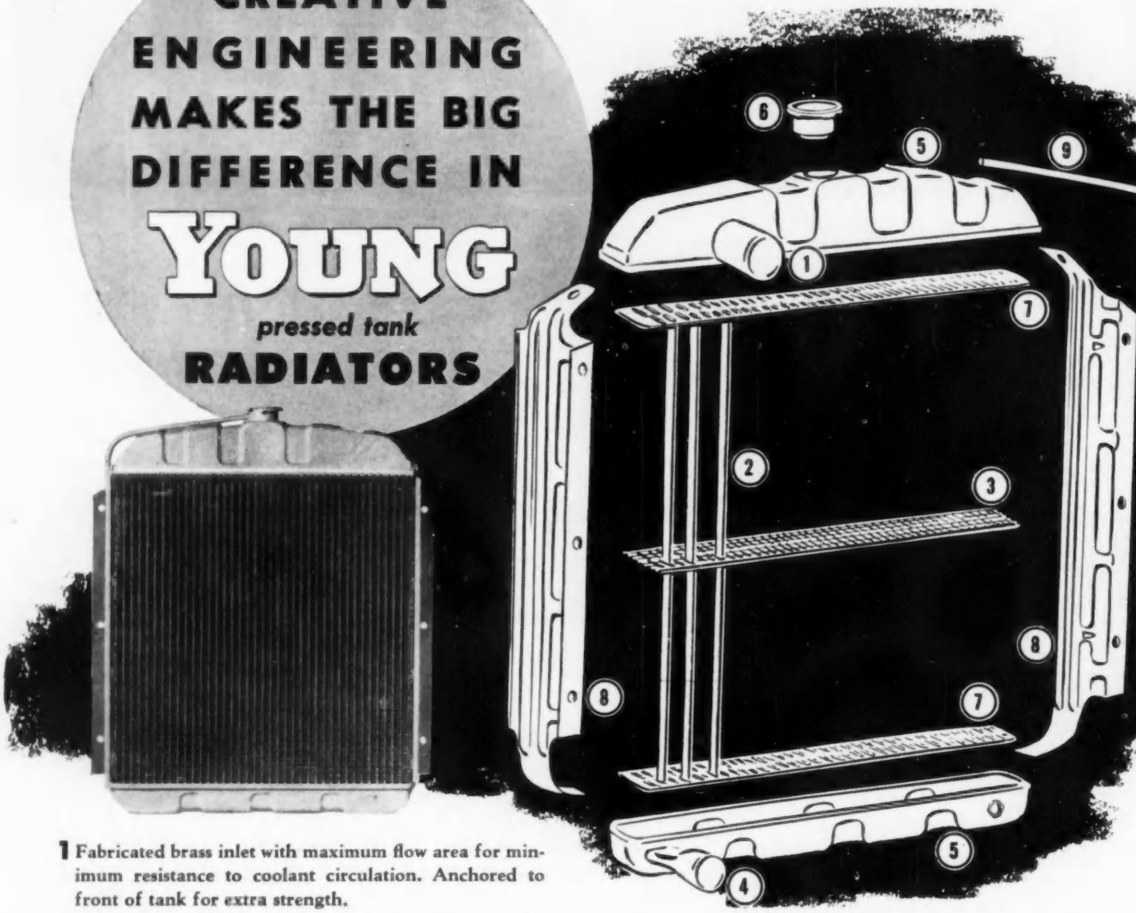
MECHANICS close-coupled type Roller Bearing UNIVERSAL JOINTS are specially designed for operation within cramped quarters, and where shafts are out of alignment — as in twin-tractor power unit silhoutted above and in rear engine cars, tractors, trucks and busses. Let our engineers show you how these MECHANICS joints will conserve space and compensate for offset shafts, in your new models. These joints fit into spaces that engineers formerly considered too short for universal joints. Our new catalog — showing complete line of MECHANICS Roller Bearing UNIVERSAL JOINTS and containing handy joint tracing kits — will be sent to manufacturers, upon request.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner • 2022 Harrison Ave., Rockford, Ill.

MECHANICS
Roller Bearing
UNIVERSAL JOINTS

For Cars • Trucks • Tractors • Farm Implements • Road Machinery • Aircraft • Tanks • Busses and Industrial Equipment

CREATIVE ENGINEERING MAKES THE BIG DIFFERENCE IN YOUNG *pressed tank* RADIATORS



1 Fabricated brass inlet with maximum flow area for minimum resistance to coolant circulation. Anchored to front of tank for extra strength.

2 Fully soldered double lockseam tube increases strength . . . provides a rugged backbone throughout entire core.

3 Fin design provides maximum air turbulance for greater heat transfer.

4 Fabricated brass outlet for a strong, light fitting and low resistance to coolant circulation. Anchored to front of tank for extra strength.

5 Die-formed bead, reinforced one-piece, heavy-duty brass top and bottom tanks.

6 Neck for pressure type cap for extra factor of safety, elimination of after boil and expansion water losses.

7 Young double-grip two-way header with lapped joint is solder sweated to the tanks with controlled temperature for a uniformly strong, leakproof assembly.

8 Full wrap around type terne plate side members secure tanks, headers and core as one piece. Care in original design of mounting features provides sturdy support, field proven in hundreds of Young Radiator equipped tractors, automobiles, trucks, busses and other mobile and stationary power units.

9 Overflow tube. For complete information write, Young Radiator Company, Racine, Wisconsin.

Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Application.

YOUNG

Heating, Cooling, Air Conditioning Products for Home and Industry.

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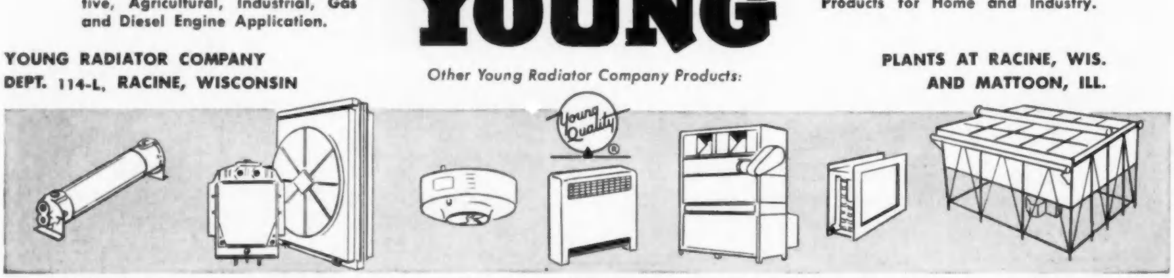


Shell and Tube Heat Exchangers — Automotive and Industrial Radiators — Unit Heaters — Convector Radiators — "YAC" Air Conditioners — Heating and Cooling Coils — "HC" Cooling and Condensing Units

Tests for Determining Mechanical Properties of Alloy Steels

This is the sixth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

The types of tests used to evaluate the mechanical properties of an alloy steel depend upon the end use of the steel involved. Generally speaking, mechanical properties are determined by tension, bend, and hardness tests, and by a group of special tests employed on tubular and wire products. These are discussed briefly in the following paragraphs.

(1) Tension tests provide means of determining tensile strength, yield point, yield strength, proof stress, proportional limit, per cent elongation, and per cent reduction of area. This sort of test subjects the steel to stresses resulting from the application of an axial tensile load to the specimen ends, the load being sufficient to rupture the specimen.

(2) Bend tests often aid in determining the ductility of steel. The severity of such a test depends largely upon the bending radius used. Several factors influence the length of radius, including thickness of the test specimen, width of test specimen, direction of test, chemical composition, tensile strength of specimen, etc.

(3) Hardness tests determine the steel's resistance to penetration. This characteristic is most commonly measured by the Brinell Test or the Rockwell Test. In the former, pressure is applied to the surface of a test specimen by means of a ball 10 mm in diameter. Two diameters of the resulting impression are measured and averaged, the average being used to determine the hardness number by means of a conversion table. In the Rockwell Test, the degree of hardness is read on a gage; hardness is measured by the penetration of a diamond point or a $^1/_{16}$-in. steel ball. Rockwell "C" scale readings are used in connection with the diamond point; "B" scale in connection with the steel ball. The "C" and "B" are the most commonly used of the several Rockwell scales.

(4) Special additional tests are often made on tubular and wire products. These include such items as hydrostatic and manipulating tests, and torsion and wrapping tests, the latter two being used only with wire.

The subject of testing and its relationships to the end uses of alloy steels has been given broad study by Bethlehem metallurgists. If you desire, they will be glad to discuss any phase of it with you, and also give unbiased opinions on such matters as analysis, proper selection of steels, machinability, etc. Call for their services at any time.

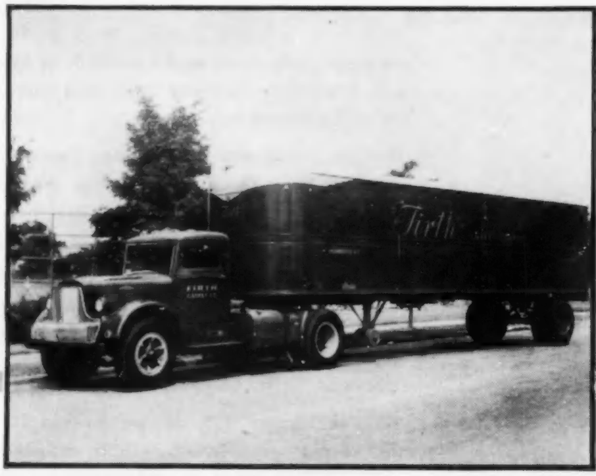
And when in the market for alloy steels, remember that Bethlehem can furnish the entire range of AISI standard analyses, as well as special-analysis steels and all carbon grades. Your inquiries will be welcomed.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM ALLOY STEELS

BETHLEHEM STEEL



Keeping downtime to a minimum is a must for heavy duty truckers. That's why so many choose Lipe Clutches.

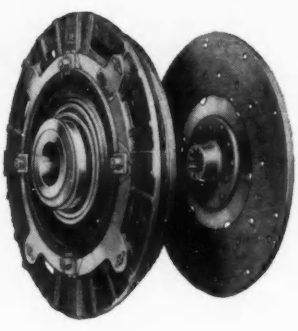
MORE ENGAGEMENTS BETWEEN TEARDOWNS

NO SHOCK! NO GRAB! NO COCKED PLATES!

LIPE *MULTI-LEVER HEAVY DUTY* CLUTCH

The Lipe *multi-lever* Clutch *gives more engagements between teardowns.* There's no grab, no shock. Strain on engine and drive-line is reduced, tire mileage increased.

Here's the reason: *There's only one spring.* Spring pressure is distributed uniformly around the full 360° perimeter of the pressure plate by 20 pressure-equalizing levers. Every part of the pressure plate touches at the Same Instant . . . with the Same Pressure. *There's no cocking of the plate.* No areas of high-speed slippage and localized burning. Circulated air keeps internal temperatures low. The clutch engages smoothly . . . requires no babying . . . holds without slippage in final engagement . . . disengages with light pedal pressure.



FLEET OWNERS

Fast, easy adjustment assures torque capacity for the full life of the friction material. No special tools required. Quick service on parts. Write for complete data on genuine Lipe parts stocked in principal cities.

LIPE ROLLWAY

Lipe-ROLLWAY CORPORATION

Manufacturers of Automotive Clutches and Machine Tools

Syracuse 1, N. Y.

Du Pont announces . . .

NEW TYPE lube oil additives

Starting with new engines, a representative number of taxicabs were tested in 50,000 miles of low-duty service to determine the effectiveness of Du Pont Lube Oil Additive 564. Typical results are indicated by the two sets of photographs above.

Notice the difference in sludge on the oil screen and timing gear cover on the left as compared to the clean appearance of the corresponding parts at the right. Those on the left were operated on a representative heavy-duty motor oil (for service MS and DG). The cleanliness of those on the right resulted from the use of the same base oil to which only Du Pont Lube Oil Additive 564 plus an antioxidant had been added.

...polymeric additives offer solution to your low-duty sludge problems

A new solution to engine oil sludge problems, particularly those caused by low-power, low-temperature, and other low-duty driving conditions is now possible. This is especially significant to the mass passenger car market, and is also of interest to the operators of urban fleets—taxis, buses and delivery services.

The solution of sludge problems is available through the use of new polymeric lube oil additives by Du Pont. Being outstanding detergents and viscosity-index improvers, these double-action additives are exceptionally economical and effective under stop-and-go driving conditions. They are especially effective in retarding sludge formation on all engine parts in contact with lubricating oil. As a result, Du Pont Polymeric Lube Oil Additives help maintain good engine lubrication and extend the useful life of your customers' engines.

Leave No Deposit

Polymeric lube oil additives, being ashless detergents, permit more efficient operation of the engine oil system. Oil screens and filters are kept clean and free from sludge. The resulting free flow of oil through the engine keeps it in better operating condition.

Cost Less Than Other Detergents

Du Pont Polymeric Lube Oil Additives are effective in low concentrations. And, when used in multi-graded oils, result in substantial savings since these new additives are both detergents and V.I. improvers. They are supplied in two molecular weights—Lube Oil Additive 564 (formerly PL-164A) and Lube Oil Additive 565 (formerly PL-164). Commercial quantities of both additives are now available.

Helping refiners to keep fuels and lubricants in step with developments in engine design through the use of additives is a continuing project of the Du Pont Petroleum Laboratory. Du Pont Polymeric Lube Oil Additives are among the latest results of efforts along these lines.

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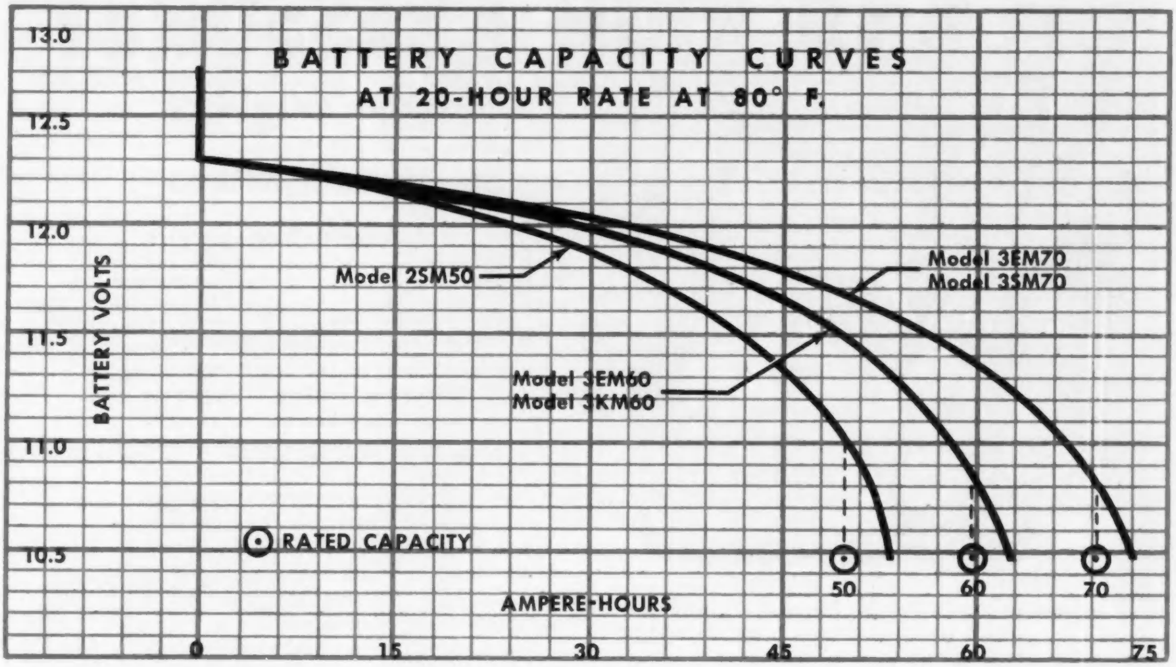
Makes the Difference

FOR PASSENGER CARS ASSURE AMPLE ELECTRICAL CAPACITY



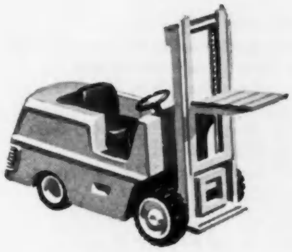
lyte leakage . . . the corrosion-proof top made possible by improved cover design and connectors protected by sealing compound . . . the generous reserve acid volume both above and below the plates. Unseen, but equally important, is the new "all-season gravity," an electrolyte adjustment best suited for all-year performance.

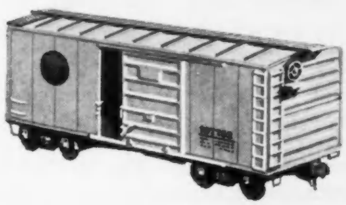
Delco 12-volt batteries for passenger cars are yet another example of how Progressive Engineering at Delco-Remy keeps always abreast—usually ahead—of developments in the automotive industry. You may be sure that Delco-Remy will be ready whenever the need arises for even more advanced electrical equipment.

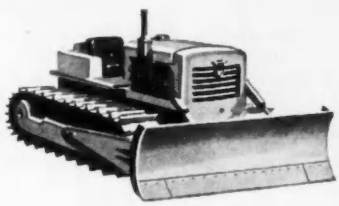
Delco-Remy

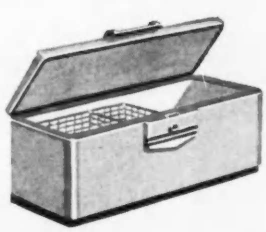
DIVISION, GENERAL MOTORS CORPORATION, ANDERSON, INDIANA

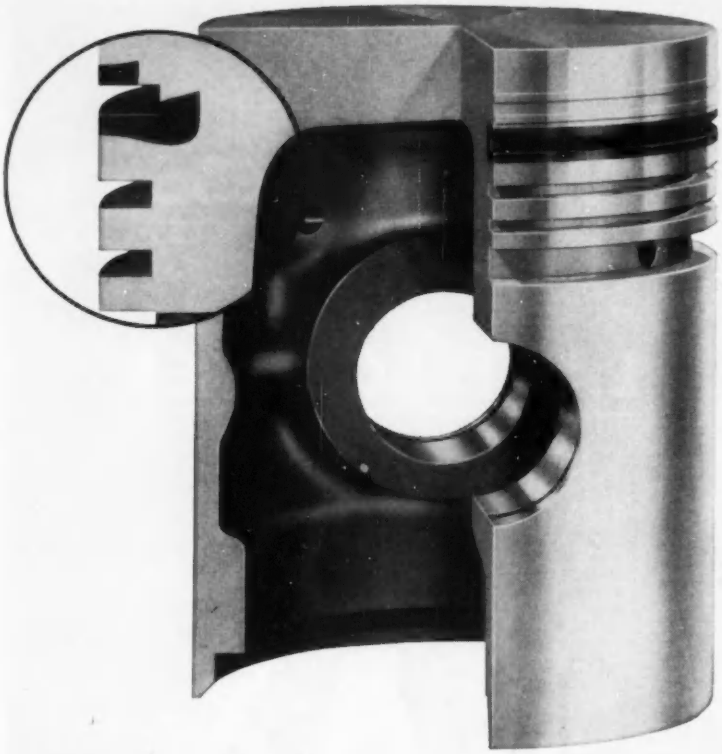
AUTOMOTIVE, TRACTOR AND MARINE ELECTRICAL EQUIPMENT











Ni-Resist is Bonded In . . .
permanently by both the Al-Fin process and the exclusive Zollner mechanical lock . . . to make separation impossible. Mileage between overhauls is greatly increased due to control of wear, burning and erosion in the ring area. This BOND-O-LOC piston was developed by Zollner Machine Works, Fort Wayne, Indiana.

Zollner reports 5 times more mileage is typical with top ring sections of Ni-Resist

"Extra Heavy Duty" accurately describes the service for which Zollner designed this piston . . .

Because Ni-Resist® eliminates wear troubles in the top ring groove.

Records prove that gasoline or Diesel engines which use aluminum alloy pistons with top ring bands of Ni-Resist, show a step-up in power and greatly improved piston life, as well as lower maintenance. The reason for this is clear.

Ni-Resist resists heat, corrosion, metal-to-metal wear and galling. By controlling ring groove wear, it stops unnecessary oil consumption and needless loss of power due to "blow by."

In addition . . . despite high piston temperatures . . . there's no joint failure because the thermal expansion of Ni-Resist closely matches that of the aluminum alloy.

Current practice of increasing engine output by using chemically treated fuels and higher operating temperatures, emphasizes the need for Ni-Resist bands in aluminum pistons, whether the engine is for truck, bus, locomotive, marine, aircraft, or stationary power plant use.

It pays to use Ni-Resist for other engine applications, also, such as exhaust valve guides, cylinder liners, exhaust manifolds, connector rings, exhaust seat rings and ball joints, water pump impellers and bodies. Insist on Ni-Resist in original equipment or replacement parts.

No other cast metal provides such a useful combination of engineering properties . . .

Several types of Ni-Resist are available to meet a variety of industrial demands. Get full information . . . mail the coupon now.

INCO
TRADE MARK

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

Please send me booklets entitled "Engineering Properties and Applications of Ni-Resist" and "Buyers Guide for Ni-Resist Castings."

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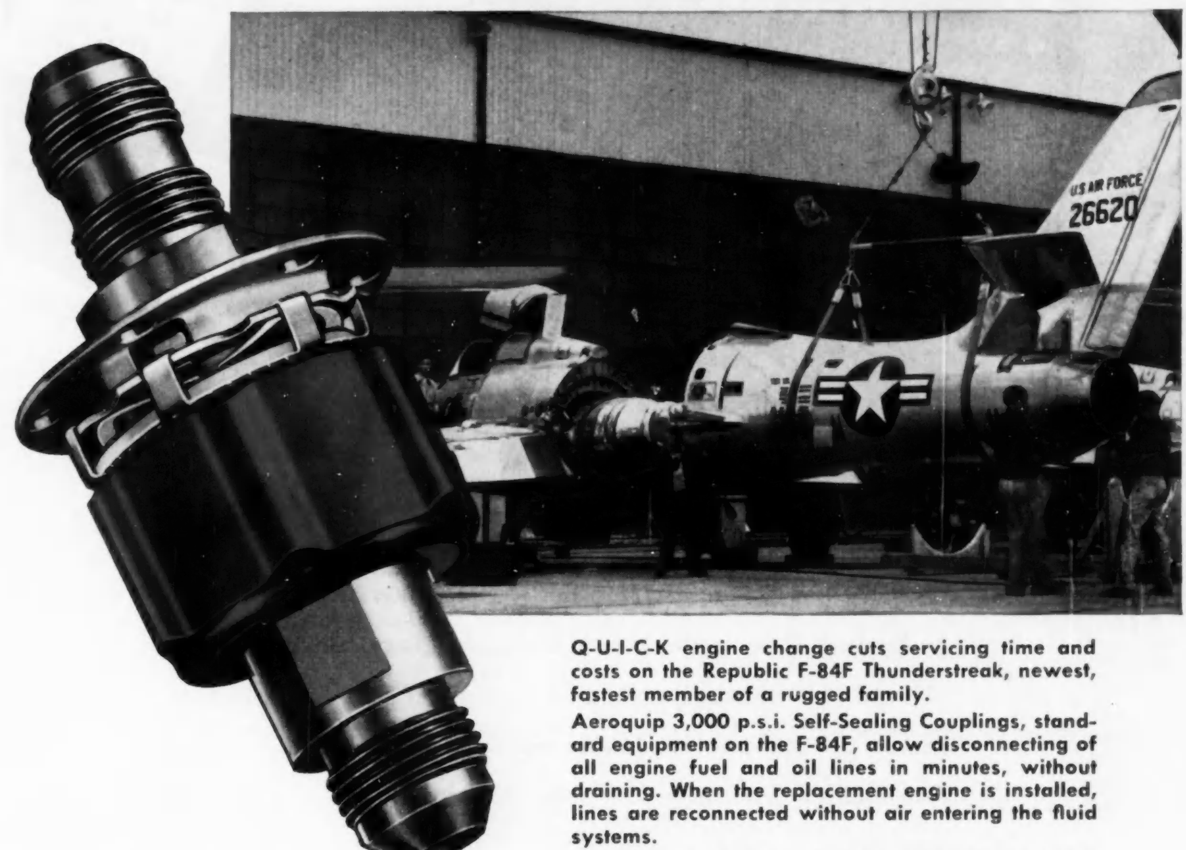
THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

On the New Republic F-84F, Aeroquip Self-Sealing Couplings

SPEED ENGINE CHANGE



Q-U-I-C-K engine change cuts servicing time and costs on the Republic F-84F Thunderstreak, newest, fastest member of a rugged family.

Aeroquip 3,000 p.s.i. Self-Sealing Couplings, standard equipment on the F-84F, allow disconnecting of all engine fuel and oil lines in minutes, without draining. When the replacement engine is installed, lines are reconnected without air entering the fluid systems.

Complete engineering of aircraft plumbing systems is an Aeroquip specialty. Write for information.

Aeroquip

REG. TRADE MARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN
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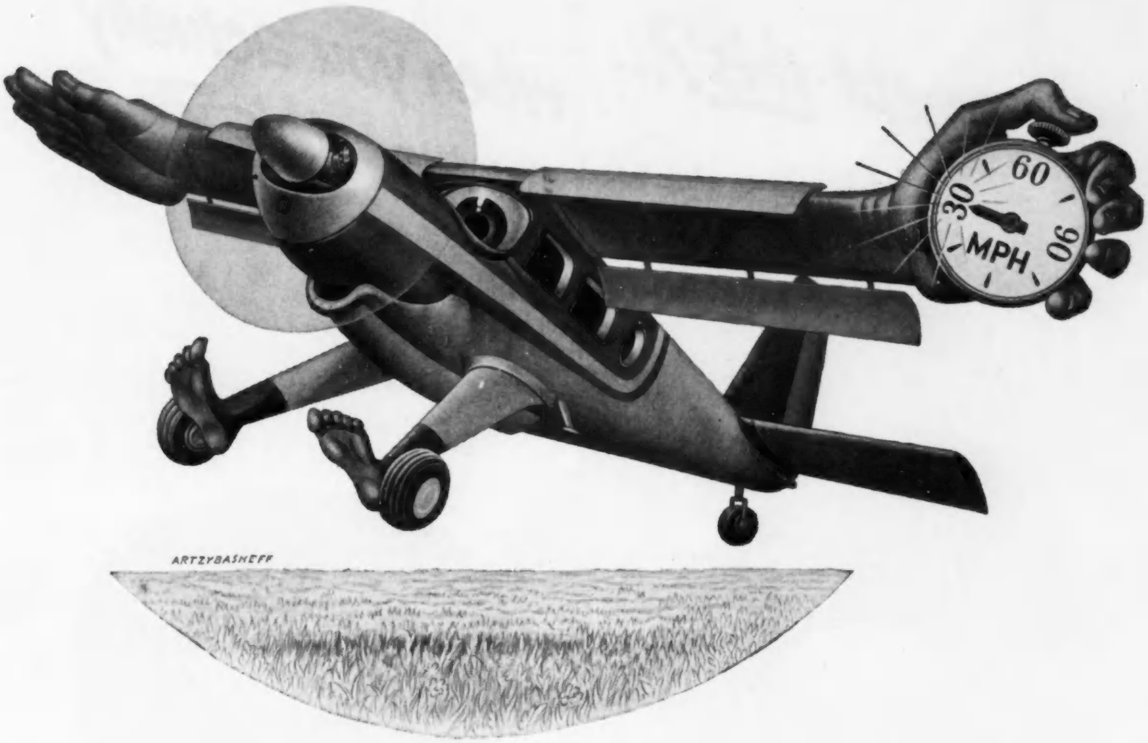
(A Subsidiary of Aeroquip Corporation)

Manufacturers of Aeroquip Flexible Hose Lines with detachable, reusable Fittings; Self-Sealing Couplings; Brazed Aluminum Elbows
LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A AND ABROAD



New speedster that can "crawl" without "stall"

Powered by a dependable Lycoming engine, this executive plane cruises above 150 mph —yet lands at 30 mph.

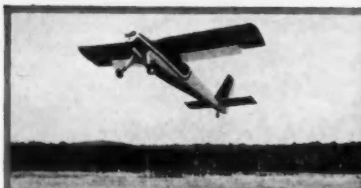
Now you can fly at 30 mph—with no danger of spin or stall. Take off and land in the "backyard" space of only 75 yards. And fly completely *relaxed* in the knowledge that your power plant is a dependable air-cooled engine from Lycoming.

It is small wonder that the Helio Aircraft Corporation expects its advanced design plane to open up a new era in private flying.

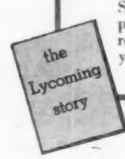
Naturally, we are proud that once again Lycoming contributes to aviation progress. Perhaps we can also help meet *your* need for air-cooled power.

Whatever your problem . . . if it can be solved by the assistance of any of the services listed with our signature . . . *look to Lycoming.*

Automotive and aviation engineers please note.



High-angle climb immediately after take-off is characteristic of the Helio Courier. It seats four . . . is powered by Lycoming's 260-h.p. air-cooled engine.



Send for Free Booklet! "The Lycoming Story" . . . 40 interesting, illustrated pages showing many ways Lycoming is ready to help you. Write for it on your letterhead.

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DIVISION OF AVCO STRATFORD, CONN.

Manufacturing plants in Stratford, Conn., and Williamsport, Pa.

Aircraft Engines
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CARMET® *blanks are preformed to your order!*

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Just out . . . 32 well-illustrated pages, containing data on all Carmet grades, and on Carmet blanks, tools, die sections, punches, draw die inserts, etc.; also special preforming to order. ● *Write for your copy.*

ADDRESS DEPT. SA-59

Above are shown two carbide metal rolls of identical composition. The one at the left cost the user about nine times as much as the one at the right. That differential was due solely to grinding vs. non-grinding. The plain face needed serrating, whereas the ready-toothed face needed nothing.

In many uses where tolerances are not too critical, CARMET blanks *preformed* to your specifications are ready for service without additional costly grinding. On jobs where finish grinding is necessary, the quality of Carmet's preforming holds grinding stock to a minimum.

Hundreds of special shapes can be preformed in Carmet. For practical suggestions that fit your needs, call or write your nearest A-L representative. ● *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda & Jarvis Avenues, Detroit 20, Michigan.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

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A-L® FINE TOOL STEELS SINCE 1854


MORE GO FOR YOUR MONEY
Designed and engineered to be the finest you can buy, Aetna bearings and parts give you real economy through highest quality . . . help your products deliver more "go," more efficiency, longer life, greater satisfaction to the user. Choose from our complete line of standard ball thrust bearings (catalog on request) or send us your blueprints if your requirements involve special bearings or hard-to-make precision parts. Engineering assistance, experimental work and quotations promptly rendered without obligation.
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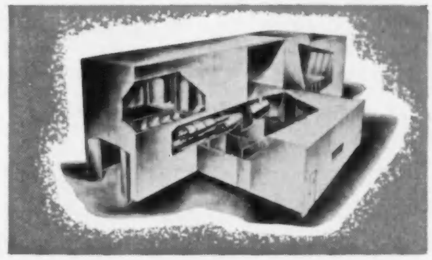
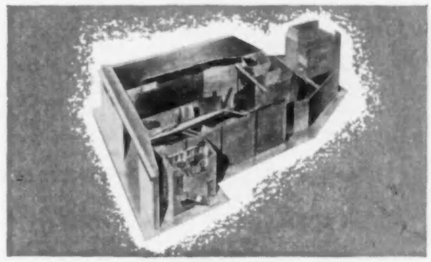
FROM THE SOUND LABS AT ISC

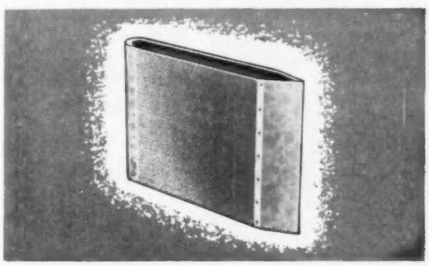
COME NEW DEVELOPMENTS IN SILENCE SERVICE

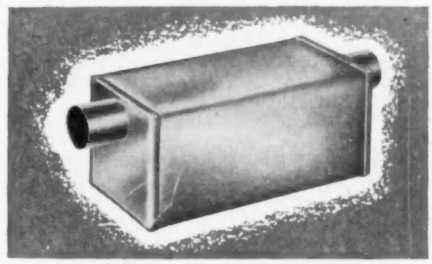


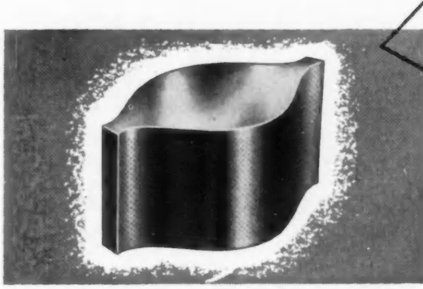
Control of aviation noise is a continuing problem requiring constant research. At Industrial Sound Control, Inc., pioneers in jet test silencing, new products and advanced methods for suppressing noise are continually under development. From the drawing boards and acoustical labs of ISC have come sound control devices which are keeping pace with the growing silencing needs of the aviation industry.

A few of the latest developments in Silence Service for the aviation industry are: ***Portable Test Cells*** (top right) — complete test cells of concrete tilt-up wall construction that may be moved to desired locations in the plant area. ***Permanent Test Hangers*** (center) — ISC "Hush Houses" designed to meet individual specifications. Complete run-up test facilities which provide for all-weather testing of jet and reciprocating engines, with noise reductions up to 60 decibels. ***Aircoustat Mufflers*** (lower right) — compact, light, airborne mufflers which silence whine of jet cockpit air conditioning systems.









Ceram-Acoustic Panels (top left) — ISC-developed ceramic coated sound suppression panels which will withstand the intense heat generated during jet testing. ***Soundstream Absorbers*** (lower left) — revolutionary new method of acoustical treatment engineered, manufactured and installed by ISC to fit individual requirements, combining maximum broad-band attenuation with low pressure drop.

For further information about the company which is the aviation industry's first line of defense against noise, send the coupon NOW for complete catalog of ISC Silence Service products.

INDUSTRIAL SOUND CONTROL, INC.
45 GRANBY ST., HTFD. 12, CONN.

Please send me your free catalog, "Silence Service for Industry".

Name ....

Company ....

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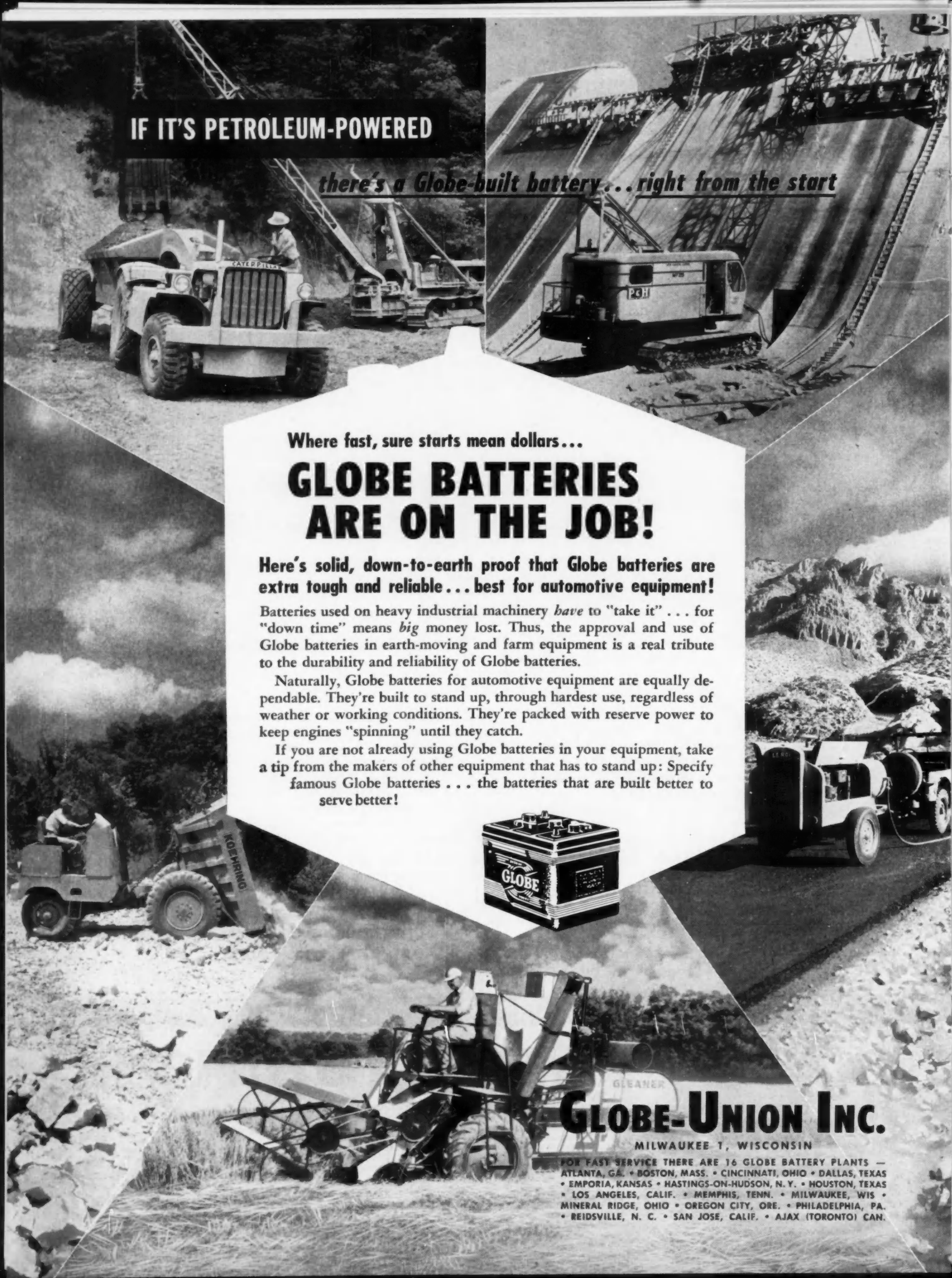
SILENCE SERVICE

Industrial Sound Control Inc.
45 Granby Street, Hartford 12, Conn.


IF IT'S PETROLEUM-POWERED
there's a Globe-built battery . . . right from the start
Where fast, sure starts mean dollars...
GLOBE BATTERIES ARE ON THE JOB!
Here's solid, down-to-earth proof that Globe batteries are extra tough and reliable . . . best for automotive equipment!
Batteries used on heavy industrial machinery *have* to "take it" . . . for "down time" means *big* money lost. Thus, the approval and use of Globe batteries in earth-moving and farm equipment is a real tribute to the durability and reliability of Globe batteries.
Naturally, Globe batteries for automotive equipment are equally dependable. They're built to stand up, through hardest use, regardless of weather or working conditions. They're packed with reserve power to keep engines "spinning" until they catch.
If you are not already using Globe batteries in your equipment, take a tip from the makers of other equipment that has to stand up: Specify famous Globe batteries . . . the batteries that are built better to serve better!
GLOBE
GLOBE-UNION INC.
MILWAUKEE 1, WISCONSIN
FOR FAST SERVICE THERE ARE 16 GLOBE BATTERY PLANTS — ATLANTA, GA. • BOSTON, MASS. • CINCINNATI, OHIO • DALLAS, TEXAS • EMPORIA, KANSAS • HASTINGS-ON-HUDSON, N. Y. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • MEMPHIS, TENN. • MILWAUKEE, WIS • MINERAL RIDGE, OHIO • OREGON CITY, ORE. • PHILADELPHIA, PA. • REIDSVILLE, N. C. • SAN JOSE, CALIF. • AJAX (TORONTO) CAN.

McQUAY-NORRIS

PISTON RINGS

Since 1910, McQuay-Norris has played a leading role in the piston ring field. This background of more than 43 years experience is available to manufacturers who require engineering and production skills of the highest standard.

McQUAY-NORRIS MFG. CO. • ST. LOUIS 10, MO.

Now! The world's

NATIONAL RED

Eliminates installation

This bright colored Redicoat coating is available on any metal encased National seal. Together with the ground circumference standard on National Oil Seals, Redicoat offers the most perfect and economical metal-to-metal bore sealing available.

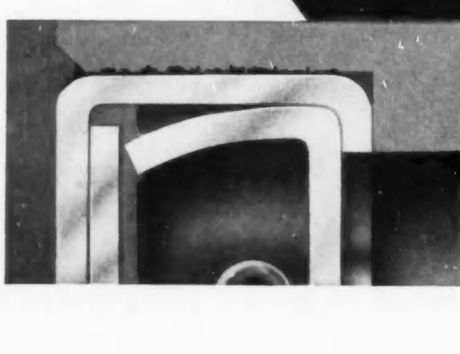
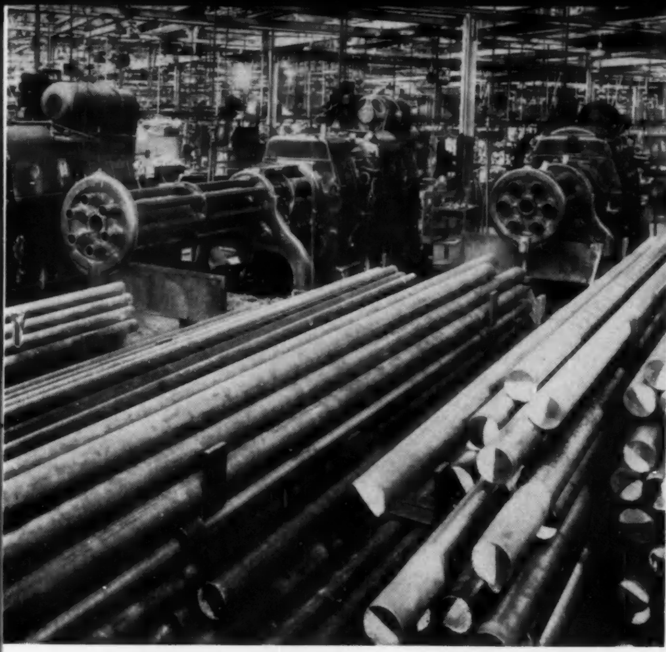


Figure 1. Cross section shows Redicoat seal installed in housing. Radial or circumferential scratches as deep as .003" are filled completely. Bore is sealed as Redicoat seal is installed; no drying or "setting" is required.

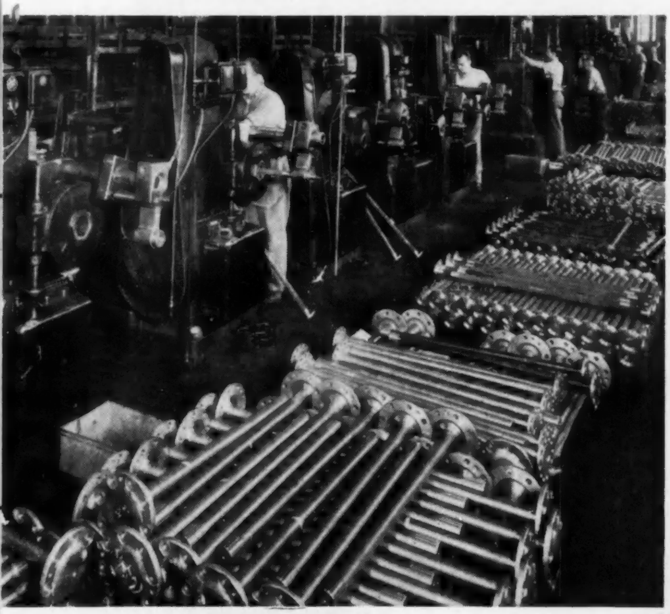


ABOVE

Idler and side pinion blanks are cut from alloy steel rounds in automatic bar machines. Teeth are then machined in the blanks, and the pieces are carburized, hardened, and finish ground.

BELOW

After heat treatment, hardening, straightening, and grinding, axle shafts come to this machining line to be turned, spot faced and hobbed. These axles must withstand hard service in tractor-trailers, farm trucks, and dump trucks.

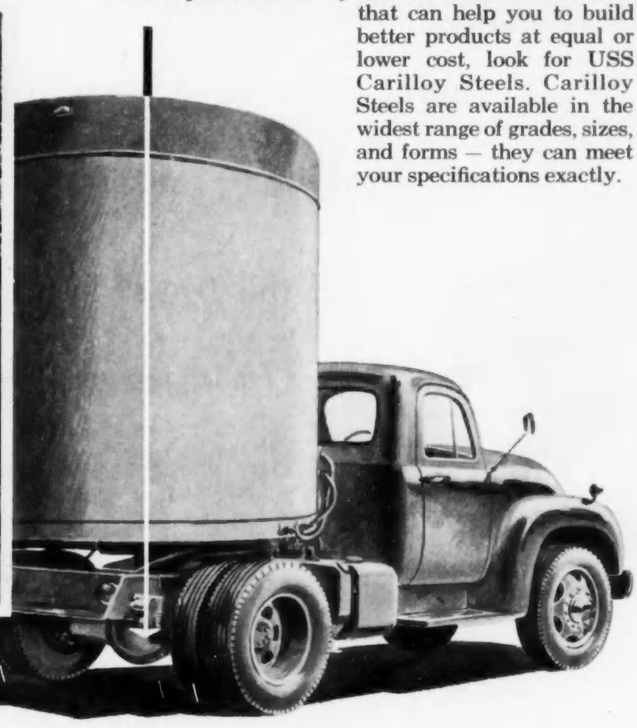


USS Carilloy Steel used in axles of heavy-duty trucks

A big cross-country tractor-trailer rig needs a high speed axle on the open road. But this same rig needs a *low* speed axle with tremendous pulling power for grinding up steep mountains and inching through city traffic. Eaton Manufacturing Company's 2-Speed axles solve both problems: they provide one gear ratio for heavy pulling power, another for high speed operation.

At any speed, the critical parts in these axles, such as shafts, gears, pinions, and spiders, must withstand severe punishment. Only high quality alloy steels can supply the needed strength and durability, and that's why Eaton uses USS Carilloy Steels.

Wherever you need steel of great strength or toughness . . . steel that enables you to increase durability and decrease weight of heavily stressed parts . . . steel that responds uniformly to heat treatment . . . steel that can help you to build better products at equal or lower cost, look for USS Carilloy Steels. Carilloy Steels are available in the widest range of grades, sizes, and forms — they can meet your specifications exactly.



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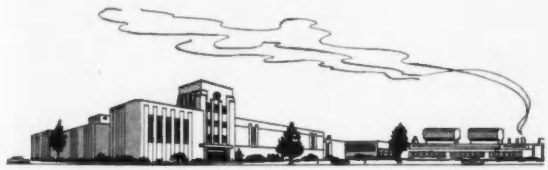

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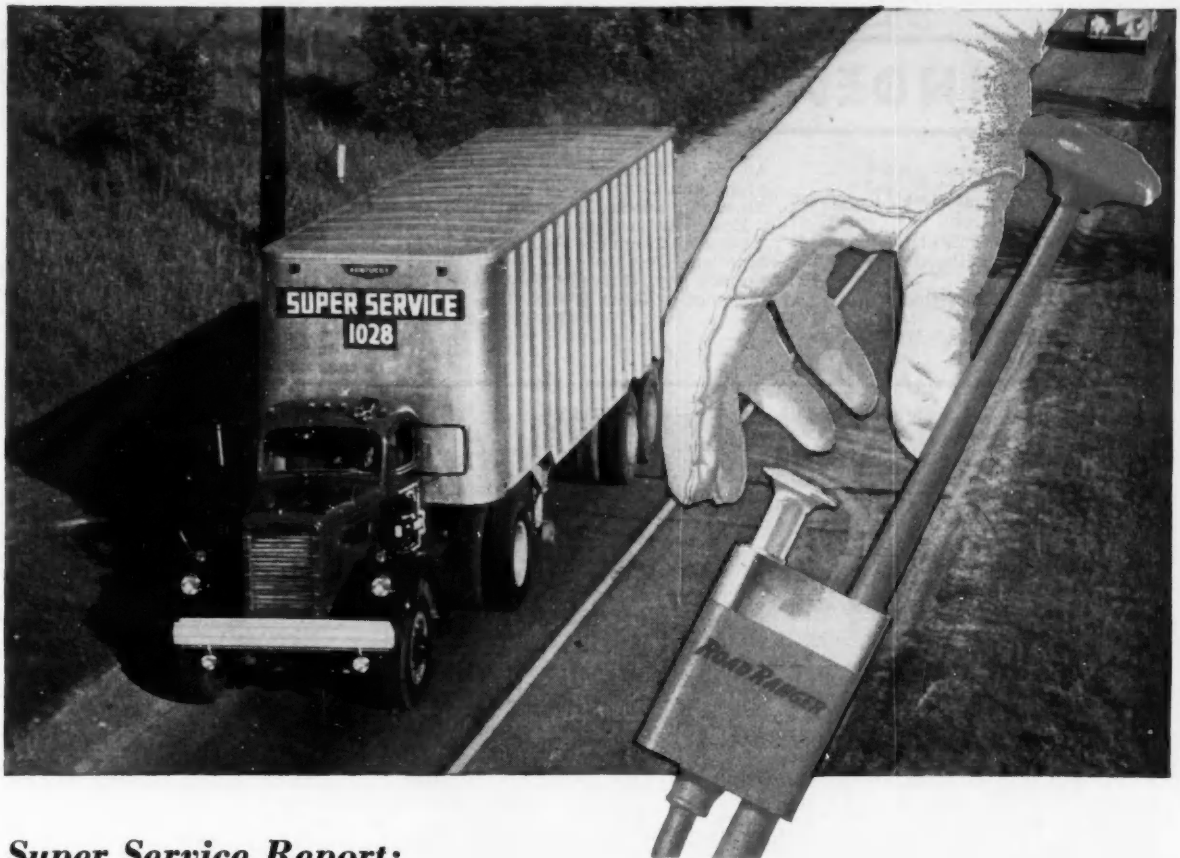

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Ray Carter

Driver Supt., Walter Haynes, "Our drivers are always bragging about higher road speeds and easier shifting."

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